ENVIRONMENTAL HAZARDS PERCEPTION:
TAYLOR COUNTY'S DILEMMA

By

STEPHEN N. MARTIN

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1999

TABLE OF CONTENTS

page

ABSTRACT iv

CHAPTERS

1 INTRODUCTION 1

Backgound 3
Rationale of the Study 7
Method of Analysis 12
The Moral Implications of Environmental Hazard Research 22

2 LITERATURE REVIEW 28

Trends in the Analysis and Management of Environmental Hazards 28
Moral Implications of Environmental Hazards Management 43
Analyses of Specific Hazards 48
Summary 82

3 HAZARDS IN TAYLOR COUNTY: PERSPECTIVE, RATIONALE, AND METHODOLOGY 83

The Context 83
Rationale for This Study 97
Research Tools 101
Analytical Procedures 105

4 RESULTS OF THE SURVEY 122

Descriptive Statistics 122
Hypotheses Tests 124

5 DISCUSSION OF FINDINGS AND CONCLUSION 150

APPENDIX 171

BIBLIOGRAPHY 178

BIOGRAPHICAL SKETCH 188

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

ENVIRONMENTAL HAZARD PERCEPTION: TAYLOR COUNTY'S DILEMMA

By

Stephen N. Martin

May 1999

Chairman: Cesar Caviedes
Major Department: Geography

Reactions to natural and industrial environmental hazards are analyzed in this dissertation. This research hypothesizes that reactions to hazards and proposed responses to those hazards differ among individuals and that the differences can be attributed to variations in the environments inhabited by people, in personal background and prior experience with hazards, as well as in perceptions of impacts (beneficial and costly) from hazards or activities associated with hazards and from proposed responses to hazards. To analyze this subject matter, residents of an area exposed to risks from natural hazards and industrial hazards have been questioned about both types of environmental hazard. Particular attention has been devoted to comparing responses from individuals residing in communities exposed to different levels of risk from hazards and impacted in different ways by activities associated with the hazards they were questioned about. It has been determined that residents of urban communities were more concerned than residents of rural communities about risks from hazards, that concern about risks from a hazard tends to decrease as the distance between one's residence and the site of that hazard decreases, that reactions to hazard management are strongly influenced by economic factors, that reactions to industrial hazards are affected more by prior experience with adverse impacts from industrial hazards than reactions to natural hazards are affected by prior experience with adverse impacts from natural hazards, and that people are far more concerned about risks from industrial hazards than from natural hazards. Contrary to expectations, this study found that reactions to hazards were not significantly influenced by the presence of children in one's household. Results of this study indicate that individuals' reactions to hazards are based on multiple factors, including the reactions of other people. Media reports and indecisiveness or debate among hazard management personnel affect public reaction. This study has established that effective management and understanding of environmental hazards and public response to those hazards is complicated and entails consideration of social, economic, and technical factors.

CHAPTER 1
INTRODUCTION

Collective reactions toward environmental hazards and policies concerning hazardous situations vary substantially and are affected by many factors, including perceptions and attitudes about hazards. Those perceptions and attitudes, in turn, are influenced by several factors. Included among these factors are: (1) personal background and values, (2) prior experience with and exposure to threatening hazards, and (3) economic and environmental impacts of hazards.

In order to effectively cope with and manage hazards, it is necessary to understand how the livelihoods of potentially affected parties can be impacted by the hazards. Individuals can be affected by hazards in different ways and to varying extents. People exposed to identical threats from a particular hazard will often perceive and respond to that hazard or to policies addressing it in very distinct ways.

This study analyzes perceptions of and reactions of people in Taylor County, Florida and the surrounding area to local hazards and measures taken in response to them. Broader issues related to environmental concerns and environmental ethics will also be addressed. Investigations of this type generally revolve around the following questions:

1. What personal, collective, and circumstantial factors influence individuals' perceptions of hazards?

2. What elements of judgement influence individuals' reactions to policies or proposals concerning the management of hazards?

3. Why do individuals often pay more attention to or express greater concern about some hazards than other hazards? and

4. Why are some individuals' perceptions of hazards and reactions towards certain threatening environmental conditions significantly different than others' perceptions of and reactions towards the same hazards?

Concerns of residents of the Taylor County area have recently been aroused by two hazards of quite different nature: pollution of local water resources from industry and property damage from a major storm. A cellulose and pulp-processing mill located outside of Perry (the county seat and largest municipality of Taylor County) is believed to be the source of the majority of water pollution in the Fenholloway River which flows south of Perry towards the Taylor County coastline. In March 1993, the coastline of Taylor County was severely impacted by a storm that caused significant damage to local waterfront property.

The concerns of Taylor County and Perry residents ought to reflect their personal values. It is assumed that personal experience with and exposure to particular disastrous events as well as to other persons' assessments of those phenomena influence one's perception and evaluation of them. Therefore, individuals with varied backgrounds and experiences should, in theory, possess differing concerns about particular issues. Much of the reason why Perry and Taylor County residents' perceptions of and reactions towards the aforementioned hazards vary can be attributed to differing personal backgrounds and prior experiences. Area residents who have been exposed throughout much of their lives to hazards ought to react differently than residents who have lived in settings relatively free from environmental hazards.

This study attempts to assess how personal background and livelihood influence awareness and concern about environmental hazards. In particular, efforts are made to analyze relationships between individuals' levels of concern about different environmental hazards (response, or dependent, variables) and several sociodemographic indicators that include household structure, residential environment and location, and extent or degree of prior exposure to and impact from environmental hazards (independent variables). The author is interested in finding out to what extent the perceptions and reactions of residents of Taylor and surrounding counties are influenced by these factors.

Background

A cellulose and pulp-processing mill, Buckeye Mill, consists of two separate mills situated on the north bank of the Fenholloway River. The river flows southwestward from the mills and drains into the Gulf of Mexico. On average, about 1200 tons of pulp are produced daily. This pulp is used in the manufacturing and production of automobile filters, clothing, disposable diapers, food products (such as sausage casings), and rayon tire cord. Chlorine is added to large quantities of water diverted from the Fenholloway River in order to meet product purity requirements. Toxic discharge is emitted from the mills directly into two retention lagoons. Wastewaters are treated in these lagoons and then released to the Fenholloway River. Each day approximately 50 million gallons of

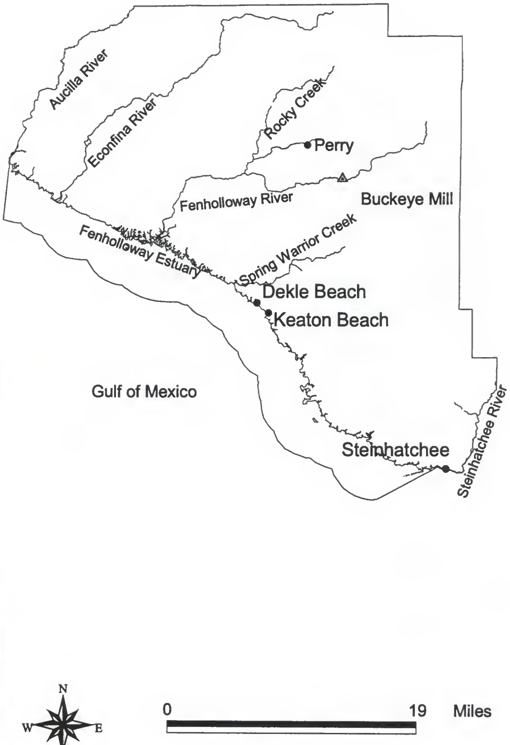

Figure 1.Taylor County

wastewater is generated and 7600 pounds of treated water is discharged into the river (State of Florida Department of Environmental Protection 1994).

The Fenholloway River drains into an estuary that flows into the Gulf of Mexico. A 1994 Florida Department of Environmental Protection study indicated that the river-estuarine system is affected by organic carbon, ammonia, nutrients, and darkened waters discharged out of Buckeye Mill. Gulf of Mexico sea grasses populations have declined due to reduced levels of sunlight penetration through darker water as well as to increased dissolved organic carbon and nutrient release. Fish population diversity has declined because of lower sea grass populations (State of Florida Department of Environmental Protection 1994).

A noticeable odor pervades in the vicinity of the mill. The Fenholloway River is the only designated Class V, industrial, water body in Florida. This has the least stringent water quality mandate of any designation; it requires that water quality be maintained at a level to support navigation, utility, and industrial use (State of Florida Department of Environmental Protection 1994).

The Fenholloway River has been heavily polluted by discharge from Buckeye Mill. Studies of water flow from springs into the river and measurements of the river's and nearby water wells' water levels indicate direct connections between the Fenholloway and the Floridan Aquifer, a major source of drinking water throughout northern Florida (State of Florida Department of Environmental Protection 1994). The water quality of many local wells has deteriorated, and it is claimed that groundwater resources in the region (well beyond the immediate vicinity of Buckeye Mill and the Fenholloway River) have been or are in the process of being impacted by pollution emanating from the factory. Concerned parties are increasingly demanding that the mill be mandated to reduce the toxicity of its discharge or shut down its operation.

Obviously, the latter demand is of extreme consequences since Buckeye Mill is the largest employer in Taylor County and its operation benefits the local economies of Perry and Taylor County. Residents of Perry and Taylor County have expressed substantial concern (fear) about the possibility of Buckeye Mill shutting down or significantly cutting back its operation. The economic interests of Perry and Taylor County, especially those of the Buckeye Mill's employees and their families, depend on continued operation of the mill.

Another aspect of Taylor County residents' perceptions of environmental hazards pertains to the previously mentioned storm of March 12-13, 1993 (sometimes referred to as the storm of the century), a hazard which hit Taylor County and much of the eastern United States with great severity. Coastal homes and structures were completely lost or damaged beyond repair. Some affected parties chose not to repair or re-build damaged structures. Others, however, opted to replace damaged or lost structures. Measures, including elevational requirements for coastal and other flood-prone area buildings, have been implemented since the storm of March 1993. Reaction to these measures as well as concern about the destructive potential of future storms varies among coastal residents of Taylor County. Whereas some residents advocate implementation of preventive measures and favor limited future development in highly vulnerable areas, other residents believe the storm of 1993 was a fluke, or once-in-a-lifetime event, which does not warrant preventive measures and unnecessary costs.

Whereas the storm of March 1993 can be classified as a *natural disaster,* pollution of the Fenholloway River from the operation of Buckeye Mill can be termed an *industrial hazard*. As noted, reaction to both hazards varies significantly, a point that raises the question: What lies at the roots of the significantly varied reactions of impacted individuals?

I would like to determine what circumstances and personal experiences influence individuals' perceptions of and reactions to the two aforementioned hazards and to the ensuing policies or proposals related to those hazards. Likewise, I am interested in discerning factors which influence the perceptions and reactions to environmental hazards in communities where flows and exchange of information, environmental awareness and concerns, as well as the economies and means of subsistence are so complexly intertwined that it is difficult to discern, at times, the real motivations and rationales underlying behavioral responses to the hazards.

Rationale of the Study

The effect of human activity on the natural environment has increased significantly and is greater today than ever before. The extent of human impact has accelerated and expanded as the human population has continually grown (fast approaching six billion today). Not only are more people present on earth, but levels to which individuals' actions impinge on a shared natural environment have become greater than ever before as per capita levels of resource consumption and environmental impact have risen. The need to monitor environmental stresses imposed by the human population is greater today than in the past.

Technologies developed and utilized by the human community to manage their affairs and surroundings have become increasingly complex. Although these technologies are utilized for particular purposes, many unintended (and difficult to anticipate) environmental effects have arisen because of the utilization of modern technology. As they become more complex and are utilized by greater numbers of people, the probability of unintended and difficult to anticipate environmental impacts (especially long-term or delayed impacts) and consequences of those stresses tends to increase.

Many unintended impacts and consequences have not been realized until well after the technologies responsible for those effects were heavily utilized and depended upon by people. The likelihood of individuals opting to abandon or reduce employment of a particular technology tends to decrease as dependency on it increases. Although users may become aware of unintended negative consequences of certain technologies, the perceived benefits derived from their use and the perceived costs of forgoing or reducing employment of those technologies may greatly outweigh the perceived costs of continued utilization of them (at least until viable alternatives become available).

As technologies become increasingly complex, the capacity for a person's use of them to impact the interests and welfare of others also rises significantly. Individuals well removed in time and/or space from points at which technologies are utilized become increasingly vulnerable to impacts from them. For instance, air and water pollution have become global problems. Pollutants continue to adversely impact the environment well after they are released and can be transported great distances by natural processes.

Although technological innovation is believed to be a means by which many natural hazards can be overcome, it has, as well, led to or augmented the severity of many new or preexisting hazards. As human population, development, and investment in the surrounding environment have grown, the costs of damages sustained from hazardous events have also increased. For example, property losses resulting from storms of equal physical intensity as prior ones are far greater today than they were a century ago.

Decisions to seize particular actions and utilize certain abating technologies are based heavily on perceptions and values. Perceptions and values, in turn, are greatly influenced by prior experiences. These decisions depend chiefly on expected outcomes; individuals generally opt to engage in actions or utilize technologies which are perceived as a means of improving their well-being. Yet, actions which provide short-term benefits or prevent short-term costs may, at the same time, result in long-term costs or prevent future benefits.

To confront and resolve the aforementioned issues of concern, it is necessary to understand the agents and actions responsible for a hazardous occurrence. This entails grasping the values and perceptions as well as the elements which influence them. Recognition of a hazardous situation is influenced by assessments about impacts resulting from hazards. Appraisal of the costs and benefits resulting from such events or deteriorating activities depends heavily on the ethical values espoused by individuals and groups. Issues such as whose interests ought to be taken into account as well as what constitutes an adverse impact affect the moral interpretation of human actions imposed upon inhabited environments.

Individuals perceive and interpret similar actions or outcomes differently from one another. This can be attributed to differing existential values that develop during childhood and are continually altered by personal experience.

Although a significant amount of research has addressed issues related to environmental hazards, environmental perception, ethics and morality, as well as the influence of demographic factors on personality and values, scarce research has focused on these issues collectively. The pertinence of this complex consideration is particularly expressed by P.C. Stern (1992):

> Particularly worrisome is the long time lag inherent in many processes of environmental change. Many of the chlorofluorocarbons that deplete stratospheric ozone continue to do so for many decades after they are released by human action. With such long lags, global changes may be impossible to control once they get started; by the time a catastrophe is foreseen, it may already be too late to prevent it. Humanity is conducting a grand experiment on its natural environment, and cannot afford to fail. We have only one earth on which to experiment ... because of the anthropogenic nature of current global change, social and behavioral science expertise would be necessary both to understand the causes and to bring about the changes in human behavior necessary to forestall, slow, or respond to global change ... has consistently recommended an increased effort to understand human interactions with the global environment...The role of social and behavioral science in the global-change research agenda is to improve understanding of how human systems produce the proximate causes, how changes in human systems might change the rate at which people alter the environment, how people perceive changes in the global environment, how people respond to the anticipation of global environmental change and are affected by experienced change, and how changes in human systems might make people less susceptible to the effects of global environmental change...The key behavioral questions include these: What values shape human responses, and how? Will humans take effective action to stop or slow the activities that harm

> environmental systems...The consequences of global change depend on how society changes while its environment is changing, and on what responses people make in anticipation of environmental change. (Stern 1992, pp. 270-2 and 287-8)

Residents of Taylor County have been directly affected by Buckeye Mill's operation and were severely hit by the storm of March 1993, and it follows that their interests will continue to be affected by the potential risks associated with both hazards. To the contrary, residents of surrounding counties have been affected to a lesser extent, if at all, by both hazards. Even though the severity of damage from the storm of March 1993 was less in the surrounding counties than in Taylor County, many of them (especially those with coastlines) are exposed to as much risk from future storms as is Taylor County. In fact, all residents of the region face some degree of risk from coastal storm impacts.

Buckeye Mill is, as mentioned, the single most significant source of employment within Taylor County, and even though residents of surrounding counties (Dixie County, Jefferson County, Lafayette County, and Madison County) also work in Buckeye Mill, the degree to which the economic interests of Taylor County's residents depend on the operation of the mill greatly exceeds the degrees to which the economic interests of the other counties depend on its functioning. Likewise, the degree to which the operation of Buckeye Mill has already impacted or poses a threat to the environment and health of Taylor County and its residents greatly exceeds the possible risks that the operation entails for the environments and health of the surrounding counties and their residents.

In this work, it is assumed that the concern about impacts and/or threats associated with coastal storms and with Buckeye Mill should vary, in theory, between residents of Taylor County and residents of neighboring counties. Data will be gathered from residents of Taylor and surrounding counties about their views pertaining to environmental hazards. Information about individuals' present and childhood residences, current and childhood family occupations, levels of education, income and age levels, family structure, the degrees to which individuals are (were) affected by pollution from Buckeye Mill and by the storm of 1993, as well as information about individuals' perceptions of and reactions to both of these hazards and to environmental hazards and policy in general will be collected by means of a written survey.

Method of Analysis

If individuals' attitudes and perceptions about hazardous conditions are, as I believe, greatly influenced by their prior experiences and present situations, then it is possible to draw relations between the perceptions and attitudes held about Buckeye Mill and coastal storms by residents of Taylor and surrounding counties and their prior experiences and present situations. Collection and analysis of data (in particular, of the indicators listed at the end of the previous section) should yield information about entrenched behaviors, awareness, and reactions concerning hazardous situations.

The method of analysis will entail: (1) Collection of data about individuals' experiences and present situations as well as about their perceptions/attitudes toward Buckeye Mill and coastal storms; (2) Statistical treatment analysis of this data to detect tendencies and hypothetical distributions; and (3) Testing of specific hypotheses addressing relationships between individuals' prior experiences and present situations and their perceptions/attitudes toward Buckeye Mill and coastal storms. Underlying premises to investigate these subjects are:

The Influence of Present Residence

The degree to which an individual's area of residence has been impacted by hazards is supposed to greatly influence his/her perceptions of and subsequent responses to hazards. Areas are often classified according to their degrees of urbanization. This classification reflects, as well, levels to which areas have been altered by human activity and lends itself to a generalization that urban environments are on average more degraded than rural environments. Environmental values and perceptions should be based on experience and ought to vary between individuals who have resided in these different settings. Taylor County and the surrounding region is predominantly rural. Although much of the region is highly rural, some areas (including Tallahassee, Leon County) have a high degree of urbanization.

In the past, significant research was devoted to the analysis of cultural gaps between rural and urban settings in the United States (Wirth 1938; Hatt and Reiss 1957; Stewart 1958; Dewey 1960; Sjoberg 1964; Glenn and Alston 1967; Glenn and Hill 1973; Willis, Bealer, and Crider 1973; Lowe and Peck 1974; Whitt and Nelsen 1975; Fischer 1978; Grasmick and Grasmick 1978; Tremblay and Dunlap 1978; Lowe and Pinhey 1982; and Lynne and Rola 1987). However, many distinctions considered to be significant in the past may be considered negligible or insignificant today.

Advances in communication and transportation have brought residents of isolated (rural) areas into closer proximity with information and ideas emanating from core (urban) areas. Likewise, residents of core areas have gained increased access to information and ideas generated in isolated areas. The length of time between the occurrence of a disaster and the disaster awareness by people well removed from it has thus been greatly reduced. Individuals' knowledge about hazards they do not directly experience has thus grown appreciably because of technological facilitators.

Although cultural gaps between rural and urban areas have decreased, and there is ample reason to believe that many differences between the perceptions and opinions of rural and urban residents have decreased with heightened communication and transportation, there is also plausible reason to believe that some differences continue to exist. It is valid as well to assume that prevalence of by-products of industrial activity (pollution, noise, etc.) and awareness of it is generally higher in urban areas than rural areas.

Residential environment choice is often influenced by considerations over which a person has, at times, minimal control, including employment opportunities and cost of living. If urban areas tend to be more heavily impacted by hazards than rural areas, then urban residents ought to be more concerned about hazards than rural residents. However, if some individuals choose to reside in rural settings to avoid many of the "ills" of urban life (including congestion, noise, pollution and other unpleasantries associated with technological hazards), then it should be expected that some rural residents would be more concerned about hazards than many urban residents. A key issue is the extent to which one's choice of residence (place) is based on perceptions of and reactions to environmental hazards. Although there may be some extreme cases in which particular settings are avoided because of an associated negative image prompted by environmental disaster (including the Love Canal area in northern New York and the Three Mile Island area in central Pennsylvania), I believe that most decisions concerning place of residence are based primarily on other considerations, including employment opportunity.

Data collected in this study will be utilized to determine if attitudinal differences continue to exist between ruralites and urbanites, at least insofar as perceptions/reactions toward environmental hazards and measures taken in response to those hazards are concerned.

Areas can be distinguished by the types of activities their economies are based on. Whereas many areas within Florida depend heavily on tourism and other light industries, the economies in other areas, including Perry, depend on heavy industry. The degree to which an area's economy is impacted by damage to or deterioration of its local environment and by activities which cause environmental damage or deterioration can vary tremendously. Individuals are attracted to areas of residence for a variety of reasons. People who go to areas with economies based around heavy industry have different considerations from people who choose areas based on tourism or non-manufacturing activities. Vacation sites are generally visited and valued because of their amenities so that activities which adversely affect those amenities subtract attractiveness and reduce the perceived values of the sites. The economies of areas in which high revenues are derived from tourism are more susceptible to impacts which reduce local amenities and subtract perceived attractiveness. Michael Edelstein (1988) writes that communities with economies based on tourism have reason to be concerned about hazards and public perception of those hazards.

> a "courtesy stigma" whereby the community also becomes stigmatized because of its direct association with the hazard...stigma is both an attribute of the hazardous project and a potential adverse impact of the project on the community. Courtesy stigma is inherently tied to image, since image is what is harmed by stigma. Therefore, a logical inference is that the degree to which stigma is feared will relate to the extent to which the hazardous facility contradicts the community image projected. An area seeking to attract tourists because of its setting...vulnerable to the devaluing of image. Accordingly, fear of stigma is likely to be a motivating force in the community's reaction to the proposed hazardous facility. (Edelstein 1988, p. 180)

If individuals' perceptions and reactions are influenced by the settings they were raised in and presently reside in (as I believe is the case), then their perceptions/reactions to hazards and hazard policy ought to be affected by the types of activities prevailing in these settings.

> lower levels of support for environmental protection found in rural areas is rooted in the nature of the occupations found in rural locales...since rural occupations such as farming, mining, and logging are typically based on the exploitation and consumption of natural resources, they might encourage an exploitative attitude toward natural resources...those who are the most directly, immediately, and drastically threatened by the costs of environmental reform will be those who will first and most strongly resist the reforms...persons employed by industries which are nature exploitative in that they are frequent sources of pollution problems would be less supportive of environmental protection than would others. (Lowe and Pinhey 1982, p. 116)

The number of people primarily employed in agriculture has decreased with the advent of industrial and post-industrial technology. Although agriculture continues to be a major employment source in many rural areas, many non-agricultural establishments have been moving away from urban centers into rural areas due to lower land costs. Buckeye Mill was attracted to Taylor County in part because of the county's lack of other major employment opportunities (and thus available labor force), relatively low land costs, and abundance of forest resources.

The Role of Household Structure

The welfare of children and future generations has increasingly become an issue of concern for family heads and reason for advocating measures to reduce the long-term effects of many hazardous activities. A study conducted in the Love Canal area established that residents' awareness of risks associated with prior dumping of toxic chemicals in a landfill in the vicinity of their homes was highly correlated with family structure. Martha Fowlkes and Patricia Miller (1987) found that adult members of households with children were far more likely to perceive a real risk and need to take protective measures to reduce future risk than were adult members of households without children.

Contamination of groundwater has been a crucial concern of residents of the area. Groundwater contamination is, as well, a major worry of many of the residents of Taylor County, both within and outside of the immediate vicinity of Buckeye Mill and the Fenholloway River. Therefore, it should be expected that the concerns of area residents living in households with children differ from those of area residents living in households without children.

The Implications of Distance Effect

Adverse impacts from Buckeye Mill and/or coastal storms have affected or may in the future affect areas beyond Taylor County. This county is adjacent to four others: Dixie County, Jefferson County, Lafayette County, and Madison County. Leon is one of many counties adjacent to at least one of the four aforementioned. Although residents of all of these units may be worried about particular environmental hazards within Taylor County, degrees of concern may vary between residents of these counties. Distance from Buckeye Mill and from the coastline may be one factor very much related to varied levels of concern.

The economic livelihood of mill employees, of the city of Perry, and of Taylor County are very dependent on the mill's operation. However, employees reside in Taylor as well as surrounding counties, so that the levels to which different areas' economic livelihood is affected by Buckeye Mill's operation vary. As distance between the mill and a selected residential area increases, the percentage of residents employed by the mill and the level of economic interests of residents affected by the mill's operation should decrease. In other words, beyond the immediate vicinity of Buckeye Mill the economic effect of the mill's operation on a person's or area's livelihood is expected to decrease with increasing distance.

Environmental impacts from Buckeye Mill's operation vary as well with distance.

The Fenholloway River, however, carries polluted discharge from the mill towards the Gulf of Mexico, and so groundwater from the vicinity of the mill flows in a southerly direction through Taylor County into Dixie County. The health and environmental interests of individuals residing in areas well removed from the immediate vicinity of the mill are thus directly affected by it, implying it is not true that the environmental impacts necessarily disappear as distance from the mill increases.

Despite this, however, there is reason to believe that worries among residents of Perry should exceed those among residents of other, further removed, portions of Taylor County. Likewise, concern among residents of Taylor County ought to exceed that of residents of other counties in the region. Analogous with this line of reasoning, it should be expected that worries about impacts from coastal storms among coastal residents of Taylor County should be greater than among inland residents of Taylor and other counties.

The Weight of Economic Concerns and Environmental Considerations

Prevailing attitudes about the surrounding environment have changed tremendously over the past half century (Buttel and Flinn 1974; Pinhey and Patterson 1976; Buttel 1979; Mohai and Twight 1987; Prester, Rohrmann, and Schellhammer 1987; O'Riordan 1989; Weiss 1990; Stern 1992; and Van Liere and Dunlap 1980). Beginning in the 1960s, major environmental awareness movements grew in the United States. Many traditional pro-industrial development and economic growth values began to be questioned. As Stern, a psychologist, wrote, the natural environment began to be perceived as a valuable entity independent of its pragmatic values to human beings.

> environmental concern reflects a new way of thinking--an ecological awareness or New Environmental Paradigm (NEP) that some investigators claim is replacing the older, anthropocentric Human Exceptionalism Paradigm in people's thinking...The NEP reflects a "land ethic"... a concern for maintaining the balance of nature as an end in itself or as a spiritual value. (Stern 1992, p. 280)

As environmental problems have surfaced and become increasingly apparent, a new global environmental ethic has emerged. Many people value protection of environmental settings independently of whether or not they occupy those settings. Likewise, people are highly concerned about economic problems, including poverty and unemployment, which do not directly affect themselves but are experienced by people in far removed locations. In general, preoccupation with environmental deterioration or adverse impacts on economies that directly affect one's own livelihood outweigh concerns about further removed environmental or economic impacts. Of interest is a comparison between environmental and economic concerns about risks and impacts from hazards and measures taken in response to them.

Natural Hazards versus Industrial (Human-made) Disasters

Forces responsible for natural hazards, including coastal storms, are physical in nature and generally should be perceived to be beyond the bounds of human responsibility. Nature, not human beings, is responsible for generation of such events. However, the impacts and consequences of natural hazards are, to some extent, a result of human activity or, more specifically, of decisions made by human beings to occupy vulnerable sites and invest resources or engage in activities within areas impacted by these disasters. Human beings are, to some extent, responsible for the consequences brought upon them by these disasters.

Unlike natural hazards, conditions leading to the generation of industrial hazards are a product of human activity and, generally, should be perceived to be within the bounds of human responsibility. Since the perceptions of natural hazards and the management and reactions to these hazards ought to differ from perceptions of industrial hazards and management of those hazards, a purpose of this study is to determine if, in fact, this distinction exists among residents of Taylor and surrounding counties with relation to coastal storms (natural hazards) and Buckeye Mill (an industrial hazard).

Hazards related to discharges from Buckeye Mill are a by-product of industrial activity. Management of human activity is a means by which risks can be controlled or even overcome. The storm of March 1993, a natural phenomenon, was, on the other hand, the outcome of natural circumstances. However, human occupance (including coastal development) is responsible for much of the risk associated with this and other storms which have impacted and will continue to impact Taylor County's coastline. Human activity is responsible for the generation of industrial but not natural hazards. Management of that activity is a means by which risks from industrial and natural hazards can be controlled or even overcome as well as a means by which industrial but not natural hazards can be eliminated. There is reason to believe that perception/reaction toward hazards and risk management differs between natural and industrial hazards. Whereas particular people or corporations can readily be blamed for the construction of Buckeye

Mill and the hazards related to its operation, no individuals or corporations can be blamed for creation of the storm of March 1993. Means of controlling or limiting impacts from Buckeye Mill's operation differ from means of controlling or limiting impacts from coastal storms.

Although storms and other natural hazards bring varied ecological benefits (including replenishment of depleted water resources and renourishment of depleted farmlands), many of the benefits are not consciously realized by the residents of impacted areas. Allocation of credit for the benefits is unusual, thus there is good reason to believe that many individuals perceive and react to as well as advocate different managerial philosophies for natural hazards and industrial hazards.

The moral implications of environmental hazard research

It is difficult to address issues related to environmental hazards and not to take account of ethical implications of these occurrences and the human reactions to them. Moral attitudes and assessments of environmental hazards depend on numerous elements, including perceived causes of the hazards, awareness of their impacts, and realization about the consequences of the effects. Individuals' livelihoods can be benefited or adversely affected by hazardous situations and endeavors. The levels to which different personal interests (short-term and long-term) can be affected by particular hazards vary tremendously.

In addition, the interests of individuals or small groups of people can conflict with those of larger groups. The welfare of Buckeye Mill employees and administrators is generally better served by the operation of the mill than are the livelihoods of other residents of the surrounding area. Individuals and groups of people possess conflicting concerns or interests.

Positive rights differ from and can conflict with negative rights. A positive right allows its bearers to engage in endeavors to improve their well-being. Buckeye Mill employees and administrators possess a positive right to improve their economic well-being via the mill's operation; coastal property owners have a positive right to privately own and develop that land. A negative right, on the other hand, protects its bearers from adverse or harmful affects arising from others' actions. Residents of Taylor and surrounding counties possess a negative right to not have their local water resources polluted by Buckeye Mill. The public has a negative right to not lose access to coastal lands or to not have to pay for repair of damages sustained by coastal property owners. In short, individuals and groups possess positive rights to utilize technology in order to improve or enhance their states of existence and negative rights to not have their states of existence adversely impacted by others' pursuits.

Moral interpretation of environmental hazards depends on level and type of environmental concern. Bases of environmental concern vary between people. Whereas the natural environment and its component parts can be perceived as valuable entities in and of themselves, the natural environment and its resources can also be perceived as valuable entities insofar as they can be utilized by human beings. The former line of thought is based on a belief that the human species is but one component of a natural system; the interests and/or well-being of the natural system supersede the interests and/or well-being of any part of the system (an "ecological" environmental ethic). The latter line of reasoning is based on a belief that the human species merits value because of its superior skills and possessed traits; the interests and well-being of human beings supersede the interests and well-being of the remainder of nature (an "anthropocentric" environmental ethic). Ethical and moral interpretation has traditionally been based on anthropocentric perspectives. It is only recently that ecological perspectives have arisen to the forefront of the field of ethics and morality.

> Environmental ethics is neither ultimately an ethics of resource use; nor one of risks, pollution levels, rights and torts, needs of future generations, and the rest-- although all these figure large within it. Taken alone, such issues enter an ethic where the environment is *secondary* to human interests. The environment is instrumental and auxiliary, though fundamental and necessary. Environmental ethics in the *primary,* naturalistic sense is reached only when humans ask questions not merely of prudential use but of appropriate respect and duty. That there ought to be an environmental ethic in this deeper sense will be doubted by many, those entrenched in the anthropocentric, personalistic ethics now prevailing in the Western world.
>
> Noticing that humans value most natural things by making them over resourcefully but value a limited number wild things as they are in themselves, we say that humans are making instrumental uses of the former type of resource but are valuing the latter type intrinsically. (Rolston 1988, pp. 1 and 112)

An additional issue of moral concern is burden of proof. Specifically, ought the burden of proof be placed on the utilizer of a particular technology or the pursuer of a particular endeavor to demonstrate that utilization of the technology or pursuit does not adversely impact the interests of others? Or, on the other hand, should the burden of proof be placed on potentially impacted parties to demonstrate that the utilization of a particular technology or the pursuit of a particular endeavor adversely impacts their interests? As technology becomes more complex and the long-term consequences of its impact continue to increase, issues related to burden of proof will become more significant. I would think today that there exists a greater rationale than ever before to place the burden of proof on the promoters of new technologies before those technologies are introduced and subsequently used by people. If unanticipated adverse impacts begin to emerge after particular technologies are heavily utilized by people, curbed use or abandonment of those technologies can prove difficult to attain.

Summarizing all of the points thus far presented, management of environmental hazards entails understanding and managing the hazards as well as understanding the populations put at risk by the hazards. How well at risk populations understand hazards significantly affects management of the hazards. A knowledge of at risk populations' perceptions of and reactions to environmental hazards and measures taken in response to those hazards should increase hazard management effectiveness.

This study addresses the responses of specific populations threatened and impacted to differing extents by two very different types of environmental hazard. Individuals' responses are influenced by many factors, including prior personal experience with hazards as well as ways in which hazards currently affect personal livelihood. Because different individuals' prior experiences and present circumstances vary, their responses to hazards should vary. This study, in fact, tests several hypotheses consistent with this line of reasoning. The study region has been and will continue to be threatened by risks from industrial and natural hazards. In order for interested parties to effectively manage these hazards and associated risks, they must understand the cognitions of people exposed to these hazards and risks. Data addressing those cognitions have been collected and analyzed; comparisons of responses from people residing in areas exposed to different levels and types of risk have been made and should reveal relations between personal experience and hazard perception and reaction.

As risk management policies are formulated and implemented and adjustments are made by affected parties, risks faced by people and their assessments of those risks change. Policies are in the process of being formulated and implemented in Taylor County. Findings from this study should bear information about how risks and assessments of them by residents of the region have changed in response to these policies. Whether or not these policies effectively elicit desired responses is a crucial issue for future policy formulation and implementation. Findings from this study should reveal information that should assist management personnel in assessments of their policies and implementation of them.

Risks from varied types of environmental hazards are bound to remain a major issue of concern well into the future. Taylor County will remain exposed to risks from industrial and natural hazards as long as its economy continues to depend heavily on industries like Buckeye Mill and people continue to reside along its coastline or in other exposed areas. Studies which gather and analyze information about public and community response to hazards should be of value to parties interested in managing risks from those hazards.

This dissertation analyzes the responses of residents of Taylor County communities highly exposed to risks from industrial and natural hazards and compares these to responses from residents of surrounding but generally less exposed communities. The following chapter is a review of several major writings about environmental hazards, moral implications of hazard management, as well as about response in specific communities which have been threatened or impacted by hazards. In Chapter 3, a detailed analysis of Taylor County's exposure to impacts from Buckeye Mill and natural hazards as well as the rationale for and methodology of this study are presented. In Chapter 4, the results of the survey of residents of the study region are statistically analyzed. This is followed by a final chapter which discusses these results and implications of them as well as suggestions for future study of response to environmental hazards.

CHAPTER 2
LITERATURE REVIEW

Trends in the Analysis and Management of Environmental Hazards

As early as the 1930s, American geographers showed serious concern about researching the impacts of environmental hazards on human communities. Initial interest was concentrated on natural disasters, especially floods. It was not until the latter half of the twentieth century that serious interest in technological or industrial hazards arose in the Social Sciences. Interest about environmental hazards has been strong, as well, within other academic disciplines (Cutter 1994).

Between the mid 1940s and the latter 1980s, there was an increase in the frequency of small-scale natural disasters (25 or fewer human fatalities) while the frequency of large-scale natural disasters (at least 1,000 fatalities) remained relatively constant. The majority of these disasters were of meteorological nature, in particular flooding of rivers from storms and coastal tidal surges from hurricanes or typhoons. More than one-third of all environmental disasters, natural as well as technological, which occurred over this period were meteorological in origin (Cutter 1994).

Although the frequency of large-scale disasters has remained relatively constant over the past half century, the extent to which these events have adversely impacted human communities has been growing. Susan Cutter (1994) attributes much of this to a highly increased worldwide human population as well as to inflows of people to more marginal and densely populated settlements with known seismic, flood, or coastal storm risks, and anticipates higher numbers of fatalities from tropical storms and other natural hazards in the future.

As Cutter notes, the vast majority of human lives lost to natural disasters over the past 50 years have been in lesser developed regions. Although casualties have been more severe in these regions than in North America, property damages have been higher in North America. Floods have been the most common and hurricanes the most deadly natural disasters in North America over the past half century.

Human deaths directly attributable to industrial or technological disasters have been far less numerous than deaths due to natural disasters. The deadliest industrial disaster, a 1984 chemical plant accident in Bhopal, India, claimed approximately 4,000 lives. Several natural disasters have claimed tens of thousands of lives, including a 1976 earthquake in China (700,000 lives) and a 1970 tropical cyclone in and around Bangladesh (500,000 lives). Although the most fatal industrial disaster occurred in a lesser developed area, the United States and Canada have experienced the greatest frequency of industrial or technological accidents of any region in the world (Cutter 1994).

Cutter noted that the use of chemicals in industry and agriculture, especially those containing highly toxic materials, has increased throughout the world so that the hazard potential of chemical mishaps has been greatly augmented. She also points out that human perception of and response towards environmental hazards have changed tremendously.

> hazards are no longer viewed as singular events, but as complex interactions between natural, social, and technological systems...Researchers are no longer simply interested in the event itself, but are dwelling more and more on the context in which the event occurs. Hazards are imbedded in larger political, social, economic, and technological structures, and it is often impossible to separate these influences from the impacts of the event...the management of risks and hazards has also become quite complex, entailing new management systems at the local, regional, and global scale. More often than not, management alternatives no longer rely solely on technical solutions, as risks and risk reduction becomes increasingly politicized, and management options are debated in the court of public opinion. (Cutter 1994, p. XIV)

Cutter, as well as G.F. White, R.W. Kates, R.E. Kasperson, J.K. Mitchell, K. Hewitt, J. Emel, and R. Peet are among geographers who have researched environmental hazards. Gilbert F. White, a pioneer among geographers in natural hazards studies, began conducting research in response to losses from river floods and focussed on human adjustment to risk and uncertainty in natural systems.

White's research has revealed several disturbing trends. Although flood control expenditures have increased significantly, damages from flooding have continued to increase. White attributed much of this to further encroachment onto river flood plains and the related losses from smaller or less severe flooding. The projects effectively reduced impacts from major flooding; but many areas which would otherwise have not been inhabited have been moved onto by people who perceived them to be adequately protected because of the projects. Many of these newly settled areas have been highly susceptible to impacts from small-scale flooding.

A 1968 study undertaken by White, Kates, and Ian Burton concluded that human responses to hazards, including increased occupance of hazard prone areas and higher losses from hazardous events, could be rationally explained if people's perceptions, viewpoints, and beliefs about likely consequences of alternative responses to hazards were taken into account and adequately understood. Personal responses to hazards as members of larger communities can differ from their responses as individuals. Linkages between people can greatly affect hazard responses. White (1973) discussed three general types of response to natural hazards:

> 1. Folk, or pre-industrial, response involving a wide range of adjustments requiring more modifications in behavior and harmony with nature than control of nature and being essentially flexible, easily abandoned, and low in capital requirements.
>
> 2. Modern technological, or industrial, response involving a much more limited range of technological actions which tend to be inflexible, difficult to change, high in capital requirements, and to require interdependent social organization.
>
> 3. Comprehensive, or post-industrial, response combining features of both of the other types, and involving a larger range of adjustments, greater flexibility, and greater variety of capital and organizational requirements. We hypothesize that the United States currently is passing the peak of the modern technological type and is beginning to catch glimpses of the comprehensive type as it emerges. (pp. 209-211)

Robert W. Kates (1971) noted that folk or preindustrial adjustments have often been based on mysticism and/or irrational or non-scientific reasoning. Damage causing natural events are frequent, the average loss per event is relatively low, and the ratio of deaths-to-damage is comparatively high. Modern technological adjustments have decreased the frequency of damage-causing natural events and the rate of death; however, the average loss per event has risen tremendously. Comprehensive, or post-industrial, adjustments have resulted in small increases in the frequency of damage-causing natural events as well as decreases in death rates and losses per event.

According to Kates, differing responses to natural hazards can be attributed to differences between hazards as well as between individuals or groups affected by hazards. Frequency of occurrence, magnitude of energy release, and suddenness of onset can vary tremendously between different hazards and significantly affect adjustment decisions. Differences between responses of individuals to hazards are based on distinct perceptions of the hazards, varied levels of knowledge about alternative adjustments, and applications of diverse criteria for evaluating and comparing alternative adjustments. The properties of natural events, perceptions of magnitude, duration, frequency, and temporal spacing most significantly affect responses to a particular hazard. These perceptions are highly related to the recency, frequency, and intensity of prior personal experiences with that hazard. According to Kates, fate control, differential views of nature, and tolerance of dissonance-creating information are personality factors that greatly influence responses to hazards.

Kates also mentioned other variables that ought to be taken into account when analyzing responses to natural hazards: environmental fit, technological feasibility, economic gain, and social conformity. These criteria can each vary in significance under different circumstances: for preindustrial adjustments, environmental fit and social conformity were the most important criteria; for industrial adjustments, technological feasibility and economic gain were the most important criteria; and for post-industrial adjustments, all four factors were highly critical.

Kates, like White, believed many models used to study human responses to hazards have been oversimplified and based on false or incomplete assumptions. The effects of natural hazards are based on interactions of human and natural variables. Consequences of hazardous events are affected by environmental settings or phenomena and by human utilization of those settings. In Kates words, *natural events systems* and *human use systems* interact to pose *natural hazards*. These hazards generate particular effects and risks which, in turn, prompt particular responses or adjustments from individuals or groups affected or potentially affected by those hazards. The consequences of hazard events can be costly and/or beneficial. Costs and/or benefits include impacts on the health and/or quality of life of affected parties as well as increased profits for producers of goods or suppliers of services desired by impacted parties. Many of the effects of hazards are intangible and/or difficult to identify or precisely measure. Nevertheless, Kates asserted that these effects should not be ignored.

Adjustments to hazards depend on numerous factors. An often applied strategy has been to take actions which minimize threats or risks from hazards and which mitigate the effects of hazardous events when they occur. Yet, adjustments can be costly and the benefits brought about by particular adjustments may not be worth the costs of those adjustments. As Kates noted, for all decision makers there is a *threshold of hazard perception* below which no adjustments are sought or evaluated; that threshold level depends heavily on perceptions of and prior experience with hazardous or natural events. It can be expected that the threshold for a particular individual or group will be adjusted as new and/or additional hazard events are experienced. When a threshold is reached, a search for known alternatives ensues and each alternative is evaluated, according to Kates, by reference to the four aforementioned criteria: environmental fit, technological feasibility, economic gain, and social conformity.

Kates advocated that models utilized to study human response to hazards should consider three distinct sets of adjustments: those that seek to *modify natural events systems*, those that seek to *modify human use systems*, and post-event *emergency* adjustments.

Kates discussed each of these sets of adjustments. The most common adjustments to modify natural events systems have been appeals to supranatural powers. Other adjustments taken to modify natural events systems have been more scientifically- or technologically oriented and include attempts to affect natural processes (for example, cloud seeding to overcome drought) and, more commonly, attempts to alter the spatial or temporal distributions of natural events (for example, construction of dams and other barriers or water storage facilities to reduce flooding and/or droughts). Numerous adjustments have been taken to modify human use systems. Whereas some of these adjustments have reflected attempts to raise damage thresholds or points at which damage begins (for instance, floodproofing of basements), other adjustments have reflected efforts to redistribute potential damages and costs (for example, federal financial assistance and shared insurance policies). Evacuation of areas is a means by which damage potential can be eliminated; but this can be costly. After hazard events are experienced, emergency adjustments can reduce subsequent losses. These include flood-fighting, fire-fighting, and emergency repairs to prevent or reduce further losses.

Kenneth Hewitt (1980 and 1983) as well as Jacque Emel and Richard Peet (1989) reviewed prevailing methods of analysis of natural hazards, including methods advocated and used by White and Kates. Hewitt believes geographic studies of natural hazards and risk have become synonymous with studies of the spatial distributions and frequencies of geophysical extremes. He pointed out that studies have been dominated by the works of White, Kates, and Burton. In a published review (1980) of their work, he noted a tendency for White, Kates, and Burton to underestimate the complexity of factors related to hazardous risks. Although White et al. did take account of social variables, they emphasized studying human beings more as individuals than as parts of communities which exert great influence on individuals' perceptions of and responses to hazards. Hewitt, on the other hand, recommended that researchers probe into issues related to how perceptions of and responses to hazards are influenced by social arrangements.

Geographic research of hazards should by its definition address issues related to human-environment interaction from a sociocultural perspective. This research has instead been highly influenced by hazards studies in other disciplines and has failed to take advantage of Geography's holistic perspective. According to Hewitt, this has constrained geographic research of hazards and has limited the contributions of geographers to the field of environmental hazard research.

> as the hazards work of geographers has been gradually adsorbed into the dominant view, the rich possibilities deriving from the ideas of human ecology and geographic diversity have also been lost. (Hewitt 1983, p. 24)

Hewitt (1983) further asserted that most studies of hazards have focused too narrowly on hazards as extreme events and have attempted to promote management strategies which contain hazards or minimize impacts of hazards on the normal day-to-day functioning of potentially affected populations. He noted that many possible alternative responses have been overlooked, especially adjustments which entail sociocultural changes, and advocated that at least as much emphasis be placed on gaining an understanding of the sociocultural factors affecting activity within at-risk areas as on gaining an understanding of the hazards in and of themselves.

Hewittt wrote that a dominant, technocratic, perspective has served the interests of institutions which have assumed responsibility for or have specifically been established to assume responsibility for management of hazards. Governments, businesses, and other institutions which fund research and/or heavily influence public policy have been prone to readily advocate this view, at least in part because it generally relies heavily on the most advanced science and technology. Because science and technology have already been recognized and heavily utilized as means of resolving problems, it is highly unlikely the roots and basic premises of the dominant perspective will be seriously challenged by those institutions.

As noted, the dominant viewpoint has advocated that hazards be managed as extreme events. It has assumed that if a community is inadequately prepared to respond to a hazard, then improved predictability is a means by which preparedness can be greatly improved.

Hazard analysis has been dominated by what Emel and Peet (1989) referred to as a *technocratic view* that has emphasized technology and engineering as means of managing natural hazards. Public policy has been a mechanism by which particular management strategies have been implemented. Major policy making decisions have been based on scientific monitoring and understanding of natural processes in order to better predict or anticipate hazardous events. Management strategies and goals have emphasized containment of natural processes where possible and rearrangement of human activities where containment has not been possible.

Emel and Peet noted three broad categories of resource management theory: neoclassical-economic, human ecological, and political-economic theories. Each of these relies to some extent, although not uniformly, on input from the physical sciences. Within the social sciences, natural resource analysis has been dominated by neoclassical-economic perspectives. As Emel and Peet pointed out, much of the early research carried out by geographers, including White, Kates, and Burton, was heavily influenced by a human ecology perspective.

> The White-Burton-Kates School of natural resources...emerged from a line of thought (human ecology)...the human ecology school sees relations between people and environment more from the standpoint of human adjustment to the environment...in White's initial formulation the basic elements of human ecological analysis are floods on natural hazards, human occupancy of flood plains, and the adjustments of occupants to flood hazards. Or as Kates later phrased it, a natural hazard is an interaction of people and nature governed by the co-existent adjustment processes in the human use system and the natural events system. (Emel and Peet 1989, pp. 62-63)

Emel and Peet noted that both the neoclassical-economic and human ecology perspectives fail to capture many essential aspects of natural hazards and offered an alternative method of analysis which stresses socio-natural origins of hazards.

Kates (1985) studied human response to technological or industrial hazards. By the mid 1980s, he noted, changes in attitude about technological hazards had become widespread across the United States. Major concerns had shifted from highly visible problems in the early 1970s to less visible problems posed by highly toxic pollutants in the mid 1980s. Kates attributed much of the increased concern over toxic chemicals to a relative lack of understanding of the impacts of those chemicals. Likewise, he noted a greater level of concern about rare but catastrophic industrial accidents than about more common but less severe or less traumatic accidents.

Attitudes about management and regulation of technological hazards have changed as concerns have shifted. By the mid 1980s, a vast majority of the American population readily acknowledged a need for regulation of toxic substances and industrial hazards.

Kates discussed an increased tendency for industries to voluntarily monitor and regulate their activities internally. Industrial corporations devoted increased resources to the management of hazardous technologies between 1970 and the mid 1980s. In many cases, regulations imposed by industries on themselves were stronger than legislatively mandated regulations. But, as Kates also pointed out, setting of standards had generally been less problematic than enforcement of those standards by both the private and public sectors.

Kates believed social movements begun in the late 1960s fostered subsequent changes in public attitudes toward technological hazards. Three noteworthy movements mentioned by Kates were: environmentalism (considered the most significant of the three by Kates), consumerism, and increased concerns about personal health. As issues of interest began to overlap between these three movements, the capacity for proponents of the movements to effectively influence legislative processes increased greatly. Several significant industrial accidents occurred and many new hazards emerged between the early 1970s and the mid 1980s, including the Three Mile Island nuclear plant accident, the Bhopal, India chemical plant accident, the Chernobyl (in the former Soviet Republic) nuclear power plant accident, the outbreak of Legionaires disease, and the spread of acquired immune deficiency syndrome (AIDS). High levels of public concern were aroused by each of these incidents.

A major goal of hazard management has been *minimization of unanticipated* events or impacts (what Kates referred to as 'surprises'). Despite increased regulation of hazards between 1970 and 1985, the 'surprises' persisted and/or increased over that period. Some of this could, in fact, be attributed to successes in hazard management. As confidence in effective regulation and management of hazards increased, concerns about and anxieties over accidents or mismanagement decreased. Kates concluded that the capacities of hazard management systems to understand modern industrial hazards, to effectively legislate and enforce compliance with appropriate standards, and to adequately punish violators of those standards and to compensate victims were limited.

C. Hohenemser (a physicist), Kates, and P. Slovic (a psychologist) (1983) have studied how particular characteristics or properties which are readily able to be quantified and commonly associated with hazards have been used in the classification and evaluation of risks from the hazards. These characteristics or properties, referred to as *descriptors*, include intentionality (the degree to which a hazard is intended to inflict harm on live organisms), spatial and temporal extents of exposure, numbers of people at risk to exposure, and mortality rates. Lay persons' and scientific experts' risk assessments were compared by the authors.

A major finding was that none of the descriptors by itself explained much of the variation between lay persons' assessments of different hazards. In particular, the survey results did not indicate that descriptors based solely on mortality figures strongly accounted for variations in lay persons' assessments of different hazards. Yet, as Hohenemser et al. wrote, scientists' and hazard experts' assessments have most often been based on mortality figures and have often failed to capture the complexity of hazards.

The authors concluded that assessments of hazards based on particular descriptors could be a highly effective means of classifying hazards and greatly aid in the management of hazards, especially when comparing hazards from competing technologies or managing novel hazards. Many new hazards cannot be understood or effectively managed until additional information becomes available. Time, however, is often a critical factor and a lack of appropriate immediate responses to these hazards can have major implications.

> Our factors and descriptors for hazardness offer a partial solution by allowing a multidimensional hazard profile to be applied...The profile of hazardness developed from the 12 hazard descriptors seems to capture the complexity of choice in...risk assessment and management better than the common mortality index. The problem of choice remains, as does the question of how should society weight the different dimensions of hazardness.
>
> In theory, each new hazard goes through a sequence that includes problem recognition, assessment, and managerial action. Often there is a need for early managerial response...Our descriptors of hazardness provide a quick profile that allows new hazards to be grouped and compared with others that have similar profiles. Such comparisons may provide industrial or governmental managers some immediate precedents,..., and, at the very least, a measure of consistency in public policy. (Hohenemser et al. 1983, p. 382)

As public concern and awareness about environmental hazards and in particular about environmental degradation arising from applications of modern technologies has increased, analysis of public attitudes toward hazards has become a major component of hazard management. Technologies have also evolved in response to increasingly complex societal aspirations.

Decisions about the development and/or utilization of alternative or competing technologies capable of accomplishing similar objectives have taken into account scientific as well as moral, social, political, and economic factors. Traditionally, decisions have been based more on the capacities of technologies to promote benefits than on the potentials to impose costs or risks. As environmental concerns have increased, decision making processes have increasingly taken adverse environmental impacts and related costs into account. As impacts have become more complex and difficult to anticipate, trade-offs between costs and benefits have had to regularly be assessed and refined; corrective measures and preventive controls have increasingly been instituted. Ido De Groot (1967) noted around the time of the outset of the recent public environmental movement that costs and gains brought about by modern technologies were difficult to express in consistent or equivalent terms. Costs and benefits have traditionally been expressed in monetary terms. Air pollution has been brought about by industrial activities undertaken to promote economic growth and other benefits. Yet, as De Groot wrote, many impacts of air pollution cannot readily be expressed in monetary terms.

Many factors, including financial and recreational opportunities, are responsible for decisions to live near and/or be employed by Buckeye Mill or to reside along the coast of Taylor County. Although the area has been beset by numerous newsworthy events associated with industrial and natural hazards, residents and employees continue to voluntarily expose themselves to risks from those hazards. Effective management of environmental hazards threatening Taylor County will require intensive public education about risks and feasible alternative responses to those risks as well as education of risk management personnel about factors influencing people's decisions to expose themselves to hazardous risks.

Moral Implications of Environmental Hazards Management

Patrick Derr, a philosopher, Robert Goble, a physicist, along with Roger Kasperson, and Kates (1983) researched hazards at industrial worksites. In particular, they compared the levels of risk experienced by employees at these sites and levels experienced by the general public because of activities undertaken at these sites. They also compared measures taken to protect worksite employees and measures taken to protect the general public. The authors introduced several morally relevant topics, including equity of protection against hazards, and concluded that in the United States there had been a double standard of protection for worksite employees and the general public. Preliminary findings had indicated that public safety standards of exposure to hazards were generally set below medically defined acceptable levels while occupational or workplace safety standards of exposure to hazards were generally set above medically acceptable levels. The authors recommended that more protective standards be implemented for industrial worksite employees.

They attributed much of the double standard to regulatory practices and standards as well as to technological, historical, and socioeconomic factors. Workplace safety standards had been set by the Department of Labor and were based on the Occupational

Safety and Health Act (OSHA) of 1970. Public safety standards, however, were set by the Environmental Protection Agency (EPA) and were based on numerous environmental standards and policies enacted by the United States Congress, including the Clean Air and Clean Water Acts (1970 and 1972). A key distinction between regulatory practices based on OSHA and those set by the EPA was that only the former required consideration of technological and economic feasibilities when setting standards. More stringent standards were generally more costly (less economically feasible) and required applications of more sophisticated technologies (less technologically feasible) than less stringent standards.

Utility theory is a commonly applied method of risk appraisal. The utility of a particular activity or event refers to the levels of cost and benefit brought about as a consequence of the activity or event. It provides a means for quantification of the net impacts of activities or events. The "expected utility" of a particular consequence of an activity or event can be expressed as the product of the consequence's utility and its probability of occurrence. This method of analysis does, however, frequently entail adoption of simplifying assumptions. Not all costs, benefits, or consequences of an activity or event can be anticipated; predicted probabilities of occurrence are often based on incomplete information and degrees of uncertainty. Utility theory requires assessments of magnitudes of costs and benefits. Although in theory it may be a scientific endeavor, in practice it entails degrees of subjectivity (Fischhoff, Watson, and Hope 1984).

Chauncey Starr (1969) wrote that studies and appraisals of the effectiveness of technological approaches to resolving social problems have traditionally been based on analyses of the benefits and costs (performance *vs* cost) associated with the technologies. These studies and appraisals, however, have generally not included all societal costs (indirect as well as direct) brought about by the technologies. Inclusion of all societal costs could greatly complicate benefit-cost analyses.

Distributional (in)equity of beneficial and costly impacts from hazards can influence management of those hazards. Benefits and risks from most activities are not uniformly distributed. Risks have often been concentrated on relatively small numbers of people who receive little or no associated benefits. Questions about acceptable levels of risk exposure are more readily resolvable if benefits and costs are experienced by the same people than by different groups.

As mentioned earlier, occupational safety is an issue of concern. Many at-risk employees voluntarily accept added risks in exchange for increased financial compensation. Starr's research revealed, however, that increased levels of compensation have often not been equivalent to increased levels of risk. While levels of compensation have increased linearly, levels of risk have increased exponentially.

> Information on acceptance of "voluntary" risk by individuals as a function of income benefits is not easily available, although we know that such a relationship must exist...The acceptance of individual risk is an exponential function of the wage...The acceptability of risk appears to be crudely proportional to the third power of the benefits. (Starr 1969, pp. 1235-7)

Starr discussed key distinctions between voluntary and involuntary risks. When an individual voluntarily engages in risky activities, his/her decision is based on his/her own value system. Decisions about whether or not to continue or at what level to continue engaging in those activities are based on individuals' own evaluations of the circumstances (associated costs and benefits) and represent what Starr refers to as crude optimizations appropriate to individuals' own value systems. This optimization process depends on internal feedback of relevant information and is relatively rapid.

Starr and Chris Whipple (1980) distinguished risks emanating from routine industrial technological operational systems and risks emanating from abnormalities in the operation of those systems. The former are recognized during decision making stages and considered acceptable in light of benefits expected from operations of the systems. The latter are not anticipated and are often a basis for system operations to be ceased or cut back.

Not all risks are immediate. Starr and Whipple noted that people tend to be more concerned about imminent threats than delayed threats. Research found that perceived levels of risk tended to be discounted across time: the greater the perceived delay until the time of risk, the less the perceived risk (all other factors held constant). Rates of discount have been found to vary between perceived benefit or expected utility and perceived costs or expected risk. This further complicates risk assessments, especially when addressing longer-term implications.

Timothy O'Riordan and Steve Rayner (1990) discussed relations between political power, social relationships, and people's perceptions of or sense of control over risks they are exposed to. Hazard response can be at an individual scale or a collective scale. As social and technological systems have become more complex, individuals' capacities to recognize or understand the full array of risks to which they are exposed have decreased. Effective management requires collective and coordinated actions of individual actors who by themselves cannot understand the full contexts of their circumstances or the implications of their actions or lack of action.

> Modern risk management is about thinking right and acting right, and that means recognizing the basis of power and institutional responsiveness to allow a collective view of a solution to emerge. (O'Riordan and Rayner 1990, p. 347)

The authors noted that the public trust factor has become especially significant. Public trust is based on a combination of knowledge and value judgment. It is highly affected by cultural and political norms and societal institutions that influence or shape relationships between individuals, their cultures and communities, and the environments in which they exist. Risk management systems function in part because people expect them to.

Management of Taylor County's environmental hazards has significant ethical implications. Although Buckeye Mill is a source of considerable benefit, not all risk bearers are beneficiaries. Likewise, several beneficiaries do not face comparable or equitable risks. Buckeye Mill poses severe environmental threats. Protection and limited development of coastal and other environmentally sensitive lands have become issues of concern throughout Florida. This study will consider several ethical issues related to environmental hazards.

Analyses of Specific Hazards

J.K. Mitchell (1974) discussed how impacts from natural hazards in the United States changed tremendously between the 1920s and 1970s. Although fatalities decreased, property and financial losses increased. Between 1925 and 1929, more than 2,000 lives were lost because of hurricanes; between 1960 and 1964, only 75 lives were lost. Financial losses from Tropical Storm Agnes (a 1972 hazard) were expected to exceed two billion dollars.

Mitchell mentioned that very little attention was paid to benefits and intangible effects of hazards. Public policy concentrated on the reduction or elimination of hazards. There are, as Mitchell noted, beneficial impacts from hazards.

Mitchell discussed several issues related to hazard perception, including how differences between individuals' perceptions of particular hazards can be affected by prior experience with hazards and related to sociodemographic characteristics. A noteworthy finding that Mitchell mentioned was a greater tendency for man-made (industrial) hazards than natural hazards to be portrayed as potential agents of global catastrophe. Mitchell contrasted perception of man-made hazards and natural hazards and concluded that age and socioeconomic factors were more related to varied perceptions of man-made hazards than to varied perceptions of natural hazards.

A key issue that has been addressed is the effects of repeated exposure to natural hazards. Studies have yielded mixed results. In some cases there has been a tendency to underestimate hazard severity, while in other cases there has been a tendency to overestimate or become "inordinately fearful" of possible future hazards. Mitchell believed the former type of response may have been compensatory for the stress of living under a chronically threatening situation.

Hazards have begun to be analyzed as functions of four sets of interacting variables: risk or probabilities of extreme events, exposure or measures of at-risk populations, vulnerability or potentials for loss, and response or choices of actions to take to reduce, avoid, or prevent losses. Theoretical models increasingly have incorporated these variables. As Mitchell mentioned, no discipline by itself has been capable of adequately addressing each of these variables. Concepts of hazard have been broadened to include factors related as much or more to contexts in which hazards were situated than to the hazards in and of themselves.

Earl J. Baker, a former student of Gilbert White, studied human response to coastal storm hazards. In a study of residents of coastal northwest Florida, Baker (1977) found that support for land use policies designed to reduce damage from storms did not, as hypothesized, decrease with increased passage of time from the date of storm impact. Baker surveyed area residents two weeks after Hurricane Eloise made landfall over the area in September 1975 as well as six months and 12 months after Eloise made landfall. Baker specifically surveyed residents about their levels of support for or opposition towards existent laws aimed at restricting construction in hurricane-prone areas. Other data collected by Baker concerned sociodemographic characteristics, length of residency in the area, the extent of damages or disruptions due to Eloise, and perceived appropriate levels of governmental regulation.

Much of Baker's study was based on an assumption that as time passes after a disaster, levels of concern about risks posed by that hazard tend to decrease. Baker's findings disputed this assumption. Although support for each of the land-use policies was strong at the time of the initial survey (two weeks after landfall), support continued to grow thereafter. Support was greater 12 months after landfall than six months after landfall. Baker reasoned that increased support might have been due to information exchanged between residents after landfall and, in particular, information about the effectiveness of land-use regulations in reducing damages. At the time of the initial survey, most respondents were not aware of the regulations. As they became increasingly aware of the regulations and the effectiveness of the regulations in preventing additional damages from Eloise, support for the regulations grew. Support grew most for regulations the respondents were least aware of at the time of the initial survey. Two other noteworthy findings of Baker's were that the most frequently cited reason for opposition to the regulations in the initial survey was based on beliefs that regulations could not be complied with because of technological constraints (in particular, that it would not be possible to build structures strong enough to meet regulatory standards) and that support for state level regulation of coastal storm hazards exceeded support for federal regulation of those hazards. Many residents noted that locally elected officials were closer to and more familiar with the hazard than were federally elected officials.

Baker (1977) noted a practical implication of his study: "To know that favorable public opinion does not *necessarily* diminish quickly is important in seeking public support for initiation of hazard zone regulations after a disaster" (p. 408).

In a subsequent study, Baker (1979) researched human responses to hurricane warnings. Baker analyzed surveys taken following Hurricane Carla (landfall over Texas in September 1961), Hurricane Camille (landfall over Mississippi in August 1969), and Hurricane Eloise (landfall over Florida in September 1975). He analyzed respondents' decisions about whether or not to evacuate their residences in response to hurricane warnings that had been issued. Several variables were studied in order to assess the strengths of their associations with decisions to evacuate. These included sources of information, evacuation advisements, expectations of impact and damages, confidence in and recollection of weather forecasts, knowledge about and prior experience with hurricanes, length of residency in the area, site characteristics of residences, and sociodemographic data.

Results of the analysis were mixed. Significant findings were limited. Respondents who recalled being advised to evacuate before Hurricane Carla were far more likely to have evacuated their residences than respondents who did not recall evacuation advisements; this relation, however, did not hold for evacuation from Hurricane Eloise. A weak relationship existed between respondents' likelihood of evacuation and a belief that one's area of residence would be impacted by a storm. But this relationship was limited to only the period shortly before hurricane landfall. A stronger relationship existed between probability of evacuation and anticipated levels of storm damage. Respondents who expected high damages from winds were the most likely to evacuate. Respondents who believed weather forecasts were accurate were more likely to evacuate than respondents who were more skeptical of forecasts. Respondents who were aware of the elevation of their residence were less likely to evacuate than respondents who were unaware of their homesite's elevation. Respondents residing in lowest lying areas were the most likely to evacuate. One of the surveys yielded a strong relation between length of residency and tendency to evacuate; data from the Hurricane Camille survey indicated that newer residents were more likely than longer-term residents to have evacuated. Weak correlations existed between tendency to evacuate and each of the following sociodemographic variables: age (an inverse relation), education level, income level, number of children in one's family, number of families living in one's residence, and home ownership (vs. leasing of residence). Each of these were significantly related to tendency to evacuate in at least one of the surveys. Additional findings of interest included the fact that respondents whose neighbors tended to evacuate were likely to have evacuated, as were respondents who discussed the topic of evacuation with other people, especially with non-family members. Despite the study's failure to uncover consistently strong predictors of evacuation, Baker found it reassuring that the most risk prone areas were the most extensively evacuated areas.

Subsequent to Baker's studies, John Cross (1984), a geographer, analyzed hazard perceptions of people who recently (within the prior four years) had purchased homes in the lower Florida Keys. It had earlier been estimated by Baker that less than ten percent of residents along the Atlantic and Gulf coasts of the United States had ever experienced a major hurricane. Cross reported that prior geographic research had found coastal residents to be more aware of coastal flood hazards than residents of urban floodplains and that residents of different coastal communities varied in their perceptions of hurricane threats. Further, Cross noted (contrary to Baker's finding) that reviews of prior studies indicated that concerns about hazards tended to diminish as time spans following hazardous events increased and as length of residency in hazard-prone areas increased. Cross was particularly interested in determining whether or not hazard perceptions of residents of the Lower Keys had, in fact, diminished as length of residency in the area had increased.

Cross noted that the Lower Keys had one of the highest probabilities for hurricane landfall in the United States. The elevation of well over 90 percent of the Lower Keys is less than five feet above sea level. Despite the fact that the area had experienced, on average, one hurricane every seven years, the Lower Keys had not been hit by a hurricane during the prior 20 years.

Cross had conducted earlier surveys of long-term resident's perceptions of the area's hazards. The results of this, later, survey revealed a higher level of concern about hazards among newer residents than had been found among longer-term residents in the earlier surveys. Respondents were asked to compare concerns about hurricanes with concerns about other local issues, including police and fire protection and roadway safety. While greater than 20 percent of respondents to this survey thought hurricanes were the most important problem, less than ten percent of the long-term respondents to an earlier survey had expressed similar concerns. Greater than 70 percent of this survey's respondents believed hurricane winds posed a problem and almost 70 percent believed hurricane waves and flooding posed problems.

Findings from this survey and from Cross' two earlier surveys concurred with the aforementioned findings of Baker's studies in regards to changing levels of concern over time. Although, as mentioned, the Lower Keys had not been recently hit by a hurricane, concern about hurricane flooding among long-term residents increased between the time of Cross' initial survey and the time of his follow-up survey of those respondents. Likewise, a greater number of respondents (new homeowners) in this survey claimed their concerns about hurricanes had increased since they moved into the area than claimed their levels of concern had decreased. Cross believed that several near misses by hurricanes and heightened recent activity by the area's civil defense offices may have accounted for some of the increased concern. Because respondents who perceived the local area's vulnerability to be lower than other areas' vulnerabilities were the least likely to be concerned about hurricanes, Cross suggested that local programs emphasize the greater risks of highly vulnerable coastal sites.

This study will, like those of Baker and Cross, survey residents of Florida coastal communities about hazard perception. As with those studies, this analysis will consider relations between hazard perception and (1) length of coastal residency, (2) prior experience with coastal storms, as well as (3) presence or absence of children in a household. Respondents will as well be asked about levels of support for proposals to limit construction in storm-prone areas. This study, like Cross', will ask subjects to compare levels of concern about different types of hazards. However, this study will emphasize response to industrial hazards as well as to natural hazards, unlike Baker's and Cross' works which emphasized response to natural hazards.

Sallie Ives and Owen Furuseth (1988), geographers, surveyed residents of coastal North Carolina about coastal erosion. In particular, the authors were interested in gaining information about perceived causes and characteristics of coastal erosion, attitudes toward alternative ways of responding to or managing coastal erosion, and perceived appropriate mitigating roles and levels of government. Ives and Furuseth noted a lack of research on coastal erosion compared to research on other natural hazards despite recent growing interest in the consequences of erosion if a large scale rise in sea level were to occur as a result of global climatic change.

Residents of two coastal North Carolina communities which had each experienced problems with coastal erosion were surveyed: the northern Outer Banks region near the northern border of coastal North Carolina and the town of Carolina Beach near the southern border of coastal North Carolina. Significant differences existed between these two areas. Erosion was not a serious problem in Carolina Beach until 1952 when an artificial inlet was cut north of town. The Outer Banks area, on the other hand, had historically experienced significant coastal erosion.

The surveys yielded several noteworthy findings. Residents of both areas attributed erosion to human as well as to natural causes. Ives and Furuseth contrasted this with a survey of residents of Bolinas, California (a coastal community in northern California) in which respondents had perceived coastal erosion to be a natural process independent of human activity and attributed part of the difference to differing resource-use values and practices. Bolinas is an environmentally active community located along a National Seashore. Residents generally do not depend directly on maritime resources as a primary means of income. In contrast, both Carolina coastal communities have traditionally relied heavily on maritime resources as a primary means of income and have pragmatic reasons to develop a thorough understanding of their coastal environment.

Respondents from both North Carolina communities believed local erosion was becoming a more serious problem and would continue to pose a problem in the future, preferred stabilization of beach sands with vegetation over sand replacement or beach nourishment as a means of preventing erosion, supported public intervention to reduce risks from erosion, and favored non-structural management approaches over structural management approaches. Despite this, opinions about susceptibility to coastal erosion and about effective means of managing local erosion varied between the two communities and may have been influenced, in part, by local factors. Residents of Outer Banks were more likely to believe that not all coastal areas were susceptible to erosion.

Ives and Furuseth noted that not all local beaches were eroding and concluded that local conditions may have influenced responses. Support for stronger laws against sand dune vegetation destruction as well as opposition towards governmentally financed assistance for repair of property damages from erosion were stronger among residents of Carolina Beach (the more developed of the two areas).

Coastal hazards have been studied outside of Geography as well. Soon after Hurricane Diana made landfall in September 1984, Timothy Beatley and David Brower (1986) surveyed residents of two coastal North Carolina communities which had been impacted to very different extents by the storm. One of the two communities, the Oak Island/Pleasure Island (OPI) area was directly hit by Diana. Impacts on the other community, Nags Head (NH), were generally limited to media reports prior to and subsequent to landfall. At the time of landfall, sustained winds had decreased to approximately 90 miles per hour, making Diana a strong category 1 or a minimal category 2 hurricane. Within 12 hours, it had been downgraded to a tropical storm. Media reports had generally exaggerated the storm's intensity; actual damages were far less than expected or reported. It was therefore hypothesized that respondents from a community, NH, which had gained most of its information about the storm and its impact from media reports rather than from first-hand experience would be more aware of and supportive of mitigation than would residents of a community, OPI, which had gained most of its information from first-hand experience. It was expected that support for mitigation within the directly impacted community would be relatively low because of lower than anticipated damages from Diana.

Conflicting theories about response to hurricanes existed at the time of the study. On the one hand, some theories advocated the gambler's fallacy which suggested that in the aftermath of a hurricane, perceived probabilities of the occurrence of another hurricane tend to decrease. Other theories, however, were based on beliefs that assessments of hurricane probability were based on events readily brought to mind and therefore that a recently experienced hurricane would increase perceived probabilities of future hurricanes. Some prior findings indicated that the recency and severity of experienced storms influenced probabilities of evacuation in response to future hurricane threats more than did the total number of storms experienced. Other studies found no correlation between anticipated future probabilities of evacuation and prior experience with hurricanes. It had been found that increased length of residency in a continually threatened setting tended to reduce perceived levels of risk. Beatley and Brower were interested in testing these theories and findings.

Survey respondents were questioned about their perceptions of the magnitude of Hurricane Diana and of damages from the storm, the probability of future hurricane strikes, the vulnerability of local structures to damages from future hurricanes, and the need for collective risk-reducing actions. Contrary to expectations, a larger percentage of respondents from the directly impacted OPI area than from NH perceived Diana to have been a strong or very strong storm. However, as expected, residents of NH were more apt to perceive the damages as having been severe (vs. moderate) than were residents of OPI.

Although a high percentage of respondents from both communities believed it was likely future hurricanes would impact the area, a higher percentage of NH respondents believed so. As anticipated, OPI residents expressed greater confidence in the capacity of local structures to withstand impacts from future storms than NH residents. Unexpectedly, however, support for mitigative actions was generally higher among OPI respondents than among NH respondents. Likewise, OPI respondents were more likely to express an intention to evacuate the area in the future. Among residents of both areas, support for measures requiring future development to be away from particularly hazardous areas in order to limit property damages exceeded support for measures limiting development on barrier islands in order to facilitate evacuation.

Bivariate analyses performed within each sample of respondents yielded two significant findings. Within OPI, it was found that the greater the perceived extent of damages from Hurricane Diana, the greater the intent to evacuate in the future. Within NH, it was found that the greater the perceived probability of future hurricanes, the greater the belief that future development should be restricted in hazardous zones.

Beatley and Brower collected personal background information from respondents, including length of coastal residency, prior experience with hurricanes while residing on the coast, age, and sex; each of the background variables was tested for strength of association with perceptions of Hurricane Diana and of a need for mitigation. Females were more likely than males to believe the capacity of local structures to withstand future storm impacts was low, to evacuate in the future, and to support mitigation. Intentions to evacuate were inversely related to length of coastal residency and to level of prior experience with hurricanes while living along the coast. Age was positively related to a belief that future hurricanes were imminent.

The surveys indicated, surprisingly, that support for mitigation (higher among OPI respondents than among NH respondents) was not correlated with perceptions of community vulnerability to hurricanes or with perceptions of the extent of damages from Hurricane Diana (both of which were higher among NH respondents than among OPI respondents). Based on this, Beatley and Brower (1986) concluded: "irrespective of perceptions about things such as damage levels or storm severity, overall the event (Hurricane Diana) served to increase awareness of the hurricane threat and concern for mitigation on the part of residents in areas where it came ashore" (pp. 266-267).

Several coastal communities face risks from technological hazards as well as from storms or natural hazards. Coastal environments are sources of several environmental amenities which can be threatened and/or impacted by economic and industrial development.

Anticipation of hazardous impacts has fueled strong reaction from potentially threatened communities. Residents of Beaufort County, South Carolina, strongly opposed a petrochemical company's purchase of and intent to build a manufacturing plant on a county site (Hall 1974). Beaufort County occupies the southernmost portion of South Carolina's coast and includes several offshore islands. Opposition from local developers, fishermen, and conservationists was especially strong.

W.W. Hall, Jr. (1974) surveyed local residents about their willingness to pay to maintain and to improve environmental amenities already being experienced as well as about their willingness to give up those amenities if compensated for the losses. Specific amenities considered were related to local air, water (for consumptive as well as recreational purposes), and beach quality. Surveyed subjects were specifically asked to consider and respond to two hypothetical situations: an industry using local coastal waters for waste disposal and compensating local residents for the inconvenience caused by the waste and an industry building a plant that would employ between 500 and 1,000 people and paying significant property taxes and/or compensating households for damages incurred from waste disposal. Hall was interested, as well, in determining if preferences for environmental quality were conditioned by annual income levels.

Respondents were willing to pay significantly more to prevent loss of beach or coastal water quality than they were to pay for improved beach or coastal water quality. Hall suggested this implied that residents of Beaufort County were pleased with the quality of the local beaches and coastal waters at the time of the survey. The amounts respondents desired as compensation for lost amenities generally exceeded amounts respondents were willing to pay for those amenities. Hall attributed this to perceptual differences. He believed that levels of willingness to pay for amenities reflected values related to immediate use of or benefit from those amenities but that desired levels of compensation for loss of amenities reflected concerns about the permanent loss of valued amenities. Hall further suggested that differences between perceptions of monetary or pecuniary wealth and of environmental wealth may have influenced responses. He defined monetary or pecuniary wealth as income plus assets that could readily be converted into monetary wealth. Environmental wealth, on the other hand, was a far less concrete concept and was based on many intangibles, such as clean air, clean water, and unobstructed panoramic vistas.

Fishing of local coastal waters was a primary means of livelihood for area residents, and much of the surveyed area had been developed as a vacation resort. The proposed petrochemical manufacturing plant was perceived to be in direct conflict with already established and prevalent local livelihoods. Subsequent to completion of the survey, the petrochemical company opted to cancel plans for construction of its plant in Beaufort County.

Between 1972 and 1976, residents of Hudson County, New Jersey (which borders the western side of New York Harbor across from Manhattan), successfully mounted drives to reject five oil-related facility proposals (Morell and Singer 1979). The area had been heavily industrialized and polluted, and the local economy was suffering. Despite the fact there had been a recent exodus of businesses out of the area, a sizeable commercial industrial base remained. Economic factors, including employment prospects had prompted officials to initially accept certain siting proposals.

Local opposition to coastal oil-related facilities was based on numerous factors, including aesthetics, pollution, safety, and socioeconomic impacts. Residents valued waterfront amenities and feared that citing of oil-related facilities would lead to future citings of additional industrial facilities.

Opponents claimed long-term interests were being sacrificed for short-term gains. Citizens expressed concerns about urban problems, including pollution and crime. Many perceived an attractive waterfront as a means of coping with frustrations commonly associated with urbanization. Officials failed to adequately take account of changing perceptions and expectations of urban residents.

State and national level decisions and policies have heavily influenced local decisions and policies. Hazard management decisions, including sitings of oil-related facilities, have often been highly based on economic and environmental factors which may or may not have been compatible with one another. This has greatly complicated decision making processes.

> individual coastal cities have the problem of determining whether economic considerations like taxes, jobs, and investment in coastal development are compatible with environmental and improved quality of life goals. If not, the community must resolve the question of which values or what mix it wishes to follow in managing coastal areas. The options open to cities, however, can be influenced by actions and policy made in the larger state and national frameworks. (Morell and Singer 1979, pp. 230-1)

Individual and group responses to hazards tend to be based on properties of the hazards as well as on contexts in which those individuals or groups function. Assessments of the costs and benefits of hazards by those who bear the costs and benefits can be highly subjective. Analysis of these assessments can be complicated. Researchers and scientific experts may fail to realize many subjective factors taken into account by at-risk parties. Residents of Port O'Connor, a small community along the Gulf coast of Texas midway between Houston and Corpus Christie, have faced a variety of risks from natural hazards and technological hazards (Pagan 1980). The community was devastated by a hurricane in 1919 and later heavily impacted by hurricanes in 1942, 1945, and 1961. Offshore oil and gas explorations have been conducted along the area's outer continental shelf. The area's coastal waters are highly productive; commercial and sport fishing are major sources of income and/or major attractions.

Unlike in many larger urban communities along the Atlantic coast, residents of Port O'Connor seemed relatively unconcerned about threats from offshore exploration for oil and natural gas. At the time of L. Pagan's survey (1980), the area's population was relatively small but rapidly growing. Most residents were concerned about hurricanes, tourism, and population growth. Yet, their reactions to each of these threats were very different. Tourism was perceived by many residents to be the single greatest threat, primarily because of its threat to the community's social structure. Hurricanes and storms, on the other hand, were not perceived as socially disruptive. In fact, many residents specifically noted that hurricanes encouraged community cohesion since everyone was threatened. Several respondents recalled tremendous cohesion in response to Hurricane Carla in 1961.

Tourism was perceived to pose multiple threats. The greatest perceived threat was disruption of the community's social fabric and lifestyle. Tourism was perceived by many to also pose economic threats. Commercial fishing was a major source of income for many. Many local residents were avid sports fishermen and/or received income from tourists attracted to the area because of sports fishing.

Many residents, especially longer-term residents, opposed incorporation of Port O'Connor and, in particular, were speculative of government's capacity to serve their interests and fearful of governmental interference in their lives. A notable exception was many of the area's retirees who had previously resided within incorporated areas and favored incorporation, in part, because they believed government was an effective means of controlling growth.

Although at the time of the survey oil and gas exploration along the area's outer continental shelf was expected to increase in the near future, residents were relatively unconcerned about any related threats. The number of new residents in the area due to the oil and gas industry was relatively small compared to the number of tourists visiting the area. Unlike tourists, many of these migrants became permanent residents and part of the community's social fabric. The oil and gas industry had provided jobs and its impacts had not yet conflicted with commercial fishing interests. It was not surprising that residents expressed less fear about the consequences of oil and gas exploration than about the consequences of tourism and/or population growth.

As noted, concerns of Port O'Connor residents differed from those of residents of many other coastal communities; residents of other communities were highly concerned about the potential environmental impacts from offshore oil and gas exploration. Residents of Port O'Connor expressed high levels of concern about social impacts from tourism. At the time of the study, many other coastal communities were actively seeking business from tourism, an industry believed to pose relatively little environmental threat.

Results of this study indicated that perceptions of and responses to natural threats can differ appreciably from perceptions of and responses to man-made threats. Natural threats are to a great extent beyond human control and must be coped with. Man-made threats, on the other hand, can be controlled. Identified or realized threats are often perceived as more threatening than unrecognized threats. Residents of Port O'Connor had already experienced and were well aware of risks from tourism; they were, however, relatively unfamiliar with and unaware of risks from exploration for and future recovery of oil and gas. Residents of other more urbanized coastal communities may have been more familiar with and thus more aware of and concerned about environmental impacts from oil and gas exploration and recovery. Although residents of Port O'Connor may have been more familiar with social impacts from tourism than with environmental impacts from the activities of the oil and gas industry, it was difficult to determine whether their concerns were based more on a relative lack of awareness of risks associated with oil and gas exploration or on tendencies to perceive the social costs of the industry to be relatively small.

Disposal of hazardous wastes has become a problem in the United States. By the early 1980's, approximately 275 million tons of hazardous wastes were being generated annually in the United States. More than three-quarters of the wastes were produced by chemical and petrochemical industries (Bailey and Faupel 1989).

Much of the waste, solid and liquid, was being disposed of or incinerated in land-based facilities. Continued disposal at these facilities was becoming increasingly difficult, in part due to stricter water and air pollution standards and "not in my backyard" (NIMBY) public opposition. Opposition was especially strong within communities in which disposal facilities were already located or proposed to be located. Firms and agencies concerned with management of these hazards advocated incineration of wastes at sea aboard specially designed ships in designated areas well removed from shore and sites of human activity, including fishing grounds and shipping lanes. It was believed that ocean incineration offered a way around aforementioned constraints to land-based incineration, stricter pollution standards, and growing NIMBY opposition. Ocean incineration had been done over European waters since the 1960's, and costs were approximately half of those of land based incineration.

Public hearings addressing test burns were held in communities along the Gulf of Mexico in Alabama and Texas. Between the time of those hearings and the scheduled time of the tests, however, the test burning permit was revised to permit burning of dioxins. Critics pointed out that lobbyists representing the company scheduled to conduct the test burns were responsible for the revision. Public skepticism and opposition climbed thereafter. When subsequent hearings were held, thousands of people attended and were nearly unanimously opposed to the test burns. Plans for the test burns were later abandoned.

Later, it was decided that incineration of wastes, but not of dioxins, would be considered for permit over waters offshore of mid-Atlantic states. However, when public hearings were held at four sites, opposition was massive and regionwide. Soon thereafter, officials decided not to allow ocean incineration until further research was conducted. Subsequently plans were abandoned altogether. Eventually, European nations agreed to phase out ocean incineration. Officials greatly underestimated extents to which coastal residents and even coastal visitors perceived the Atlantic Ocean and Gulf of Mexico to be part of their own backyards. There is little reason to doubt, as well, that people who reside along or regularly visit Taylor County's coastline perceive the Gulf of Mexico to be part of their backyards.

Sitings of land-based hazardous waste facilities have been subject to considerable debate. Although these facilities pose numerous threats, not all threats have necessarily been taken into account or given equal consideration when decisions about proposed sitings have been made. Past research has focused on acute and chronic public health effects associated with these facilities. Yet, accurate measurement of many health effects has been difficult. Far fewer resources have been devoted to studying the social and economic impacts of hazardous waste facilities on communities in which they have been located. Many of the social and economic effects, including changes in property values and migration of population, can be more readily measured than many of the health effects (Greenberg, Anderson, and Rosenberger 1984).

Land-based waste facilities can be a source of benefits. These facilities can positively impact local economies by providing employment opportunities and tax revenues. Most land-based hazardous waste facilities have been sited in poor rural areas, to a great extent because of economic factors.

Results of a study of communities in Minnesota and central New Jersey conducted by M.R. Greenberg, R.F. Anderson, and K. Rosenberger (1984) failed to support hypotheses that facilities tended not to be located in communities with strong local government, communities with environmentally active voters, or communities near important seats of political power. The results did, however, support hypotheses that facilities tended to not be located in communities whose populations were relatively wealthy or those whose populations were composed of relatively small percentages of foreign born immigrants, young or elderly people, and/or minorities. The strongest relationship was found between facility siting and economic status, an inverse relationship.

Case studies and comparisons of two very different New Jersey communities with abandoned hazardous waste facilities yielded noteworthy results. Plumsted, a rural community, had experienced severe social and economic impacts. Concerns about local groundwater pollution were strong. Development of the area had greatly declined. The area was labeled a "mini Love Canal" by media, and it was reported that people were afraid to move into the area. Hazardous materials disposed at the facility had not been generated in Plumsted. The impacts or costs and benefits generated by the creation and subsequent disposal of hazardous materials had been maldistributed; those who reaped the benefits had not endured the costs. An undue burden had been experienced in

Plumsted.

Edison, an urban industrial community, was impacted far less severely than Plumsted, despite the fact that major problems at the local Kin-Buc landfill during the prior decade, including fire, explosions, and death, had received considerable media attention. Surprisingly, new housing had been constructed within one mile of the site and local property values had appreciated. The social and economic impacts in the urban community of Edison were very different from the impacts experienced in the rural communities of Plumsted and Love Canal, New York (to be discussed). The authors speculated that much of this difference was because the construction of a major trunk sewer through the Kin-Buc area was encouraging development in Edison. Little additional local space was available for development, and people residing in or considering moving into the community were already tolerant of the sites, sounds, and smells associated with dense automobile traffic, industry, and landfills.

No community which has been adversely impacted by hazardous wastes has received more publicity than Love Canal. During and following World War II, toxic municipal and chemical wastes were deposited into an abandoned canal and subsequently covered with a 'cap' of indigenous soil (Fowlkes and Miller 1987). The area was later developed into a residential neighborhood. In time, chemical wastes seeped to the surface of the soil cap. In 1978, residents of the area were notified of a 'grave and imminent peril' posed by exposure to the wastes. Although at the time it was known that many of the chemical wastes had adversely affected human health, it was not known to what extent the health of the residents of the local area had been adversely affected or placed at risk by the wastes.

At the time of the notification, the community was intact. The population was diverse with respect to occupational status, family status, and age. Although predominantly blue collar and lower-middle class, there were a substantial number of white collar households and elderly people in the neighborhood.

Response to the declared state of emergency varied highly among community residents. Residents became divided among and against themselves. Much of this was due to the uncertainty about the situation. There was little basis for consensus among area residents about what the consequences had been or would be in the future.

The declaration initially called for temporary evacuation of only the most vulnerable residents, pregnant women and infants, living in the most vulnerable homes (those abutting the canal). Many residents, in light of the degree of uncertainty, strongly questioned the State's capacity to maintain that other parties were not at serious risk. Later, the State yielded and revised its evacuation order into a near mandate for the permanent relocation at state expense of all residents in the vicinity of the canal. This was based more on political pressure than on new scientific evidence about expanded risks.

Chemical manufacturing had long been and continued to be a major source of livelihood in the region. Greater than half of the labor force was employed in the chemical or a related industry. Over the past century, local government had greatly accommodated the chemical industry in decisions related to waste by-products. An in depth survey and analysis of residents' reactions and responses to the crisis was conducted by Martha Fowlkes and Patricia Miller (1987).

Two prevalent but very opposed viewpoints of residents emerged. "Minimalists" (about one-third of the area's households) believed that chemical contamination was relatively limited in scope, posed little serious health risk, and that many area residents had overreacted and exaggerated the risks posed by the chemicals. They particularly feared decreasing property values and a deteriorating quality of life in the neighborhood because of others' overreactions. Most chose to remain in their homes or reluctantly moved because of these fears.

The remaining two-thirds of households were classified as "maximalists" and believed chemical contamination had migrated throughout and beyond areas declared eligible for assisted relocation and posed a serious health risk. The vast majority of these households relocated out of the area; many had been highly instrumental in pressuring government officials to expand the boundaries of relocation. Maximalists were far more inclined than minimalists to seek information about the risks posed by contamination.

Fowlkes and Miller greatly attributed the highly varied responses of minimalists and maximalists to the very different social worlds they inhabited before and throughout the crisis. Age and household structure were found to be significantly related to type of response. Minimalists tended to be at or near retirement age (older than maximalists) and live in childless households. Prior to the crisis, they generally abstained from social involvement with other area residents. Many were or had been employed by local chemical or related industries and tended to perceive chemicals, in general, as beneficial to society. They advocated that industrial corporations, not governments, be entrusted to manage problems. Major concerns of minimalists were related to welfare or household finances.

Although children did not live in all maximalist households, virtually all households with children were maximalist. They were involved socially with other neighborhood households and readily corresponded with other area residents about the crisis and their related experiences. They were more sympathetic than minimalists to others' accounts of their crisis related experiences. Maximalists regularly attended neighborhood meetings and were far more likely than minimalists to raise issues with crisis management authorities. Major concerns of maximalists were health-related. Even though not all maximalists had experienced health-related problems, all maximalists (unlike minimalists) considered others' health claims to be credible.

Although initially maximalists considered state health officials to be credible, in time they became increasingly distrustful of officials. State officials' studies concluding that the initially declared boundaries of contamination were sufficient had not been open to review or criticism. Studies conducted by independent scientists that had suggested stronger associations between chemical exposure and adverse health impacts were, however, open for review and criticism.

Fowlkes and Miller concluded that both of the prevailing viewpoints were highly influenced by life-cycle factors and could readily be interpreted as rational responses to a highly ambiguous and uncertain context. Elderly residents, especially those who had lived in the area a long time free of impact from contamination, were more concerned about risks associated with advancing age than risks from chemical contamination. Many maximalist households had experienced symptoms that could not be medically explained until the time of the emergency notification. Awareness of the presence of contaminants offered a plausible explanation.

> In the final analysis, then, both the maximalist and minimalist perspectives on risk at Love Canal must be understood as *equally and simultaneously* subjective and rational in the context of the respective considerations and concerns that gave rise to each perspective. The maximalists began as residents whose age, household composition, ties to group life in the neighborhood, and family health experiences quite naturally encouraged them to interpret the situation in high risk terms...The minimalists, on the other hand, had less at stake in assigning legitimacy to questions concerning the safety of the area by virtue either of their own life-cycle concerns or general value system. (Fowlkes and Miller 1987, pp. 72-3)

Much of the polarization which emerged between residents of Love Canal could be attributed to contextual ambiguities and uncertainties about cause-effect relationships. Although State health officials asserted that management of the hazard was a scientific or technical issue, the results of this study indicated that the responses of residents of Love Canal were based more on socially than technically driven factors. As area residents assessed a highly ambiguous and uncertain circumstance, their polarization damaged the social fabric of their neighborhood. Whereas hurricanes, a natural hazard, were believed to have enhanced community ties and relations in Port O'Connor, chemical contamination, an industrial or technological hazard, tore apart much of the social fabric of the Love Canal community.

A community's response to hazards is affected by levels to which it has been threatened or impacted by the hazards and critically affects levels to which its social fabric is impacted by hazards. Research has indicated that community response to proposed sitings of hazardous waste facilities can impact a community's social fabric very differently than community response to evidence of exposure to contaminants already released from local facilities (Couch and Kroll-Smith 1994).

Stephen Couch and Steve Kroll-Smith (1994) compared community response to the proposed siting of a facility within that community and community response to evidence of contamination from wastes already released into that community. Both communities, Beaver Township and Centralia, are located in rural Pennsylvania.

Couch and Kroll-Smith noted that responses to hazards are affected by the degree to which human-environment relations have been disrupted as well as by appraisals of the disruptions. Appraisals can be heavily influenced by social ties and interaction. The authors hypothesized that community solidarity would be enhanced by response to hazardous waste siting proposals but undermined by response to evidence of exposure to already released contaminants. At the time a community responds to a proposed waste facility, the community has not been impacted by the facility; human-environment relations have not been disrupted. Different responses of individuals tend to be based on different perceptions of potential disruptions. When a community responds to evidence of exposure to already released contaminants, the community has already been impacted; human-environment relations will without appropriate actions be disrupted. Different responses tend to be based on different perceptions of an already experienced source of disruption. Levels to which different individuals' lives and welfare will be disrupted will vary.

Couch's and Kroll-Smith's study confirmed that siting proposals generated community consensus and that evidence of exposure to contaminants generated the formation of many different and conflicting responses. In 1989, the citizens and local officials of Beaver Township voted overwhelmingly to reject a proposed siting of a landfill. Despite low income levels across the area as well as significant expected revenues from the facility, residents and officials shared many concerns and successfully defeated the proposal. Community social ties were enhanced as a result of the proposal.

A fire discovered in 1962 in Centralia eventually spread into abandoned underground mine shafts and vented poisonous gases through foundation cracks into houses. Efforts to contain the fire proved to be fruitless. In 1981, citizen groups emerged voicing different concerns about the crisis. Whereas some were concerned about environmental (including health) risks posed by the hazard, others were concerned about repercussions generated by the protests and concerns of citizens. Several groups were at odds, as well, with local officials' response, including efforts to promote purchases of local homes and businesses. Conflict between different groups generated additional stress for many area residents. Social confrontations emerged, and many existing community ties were broken.

Responses to the hazards or potential hazards in both areas were based on appraisals of perceived risk. Appraisals were affected by the contexts in which they were made. Appraisals of risks of the proposed siting were made in the absence of actual risks or, as Couch and Kroll-Smith wrote, in the context of a relatively stable socio-natural system. Community opposition was generally based on a belief that stability was at risk and on a desire to preserve that stability. Appraisals of risks from the already released contaminants were made in the presence of risks or in the context of a disrupted socio-natural system. Toxics released by the fire burning under Centralia were invisible and transported underground. Different households were impacted to different extents. Several different conceptions of and responses to the crisis emerged. As in Love Canal, ambiguities constrained the emergence of a community-wide consensus. Residents were forced to respond to impacts already being experienced. As Couch and Kroll-Smith summarized, the actual presence of a hazard greatly complicated risk appraisals.

> if hazard perceptions in siting disputes are solely a derivative of the structure of human relations and thus managed exclusively on a social terrain, hazard perceptions in exposure conflicts include both the pattern of human relations *and* the physical presence of the pollution in the community. (Couch and Kroll-Smith 1994, p. 35)

Issues, such as the proposed siting of an industrial hazard, which promote community consensus can enhance a community's social fabric. No part of a community benefits from the hazard itself. Traditional social boundaries can be transcended by common desires and interpretations of risk. Issues, such as contamination from invisible but already present toxics, which promote perceived risk and uncertainty can erode a community's social fabric. Multiple and conflicting interpretations of risk can promote the emergence of interest groups at odds with one another. Many traditional social ties can be transcended by conflicting desires and interpretations of risk.

Couch and Kroll-Smith argued that rural communities were more vulnerable than urban communities to impacts from environmental hazards. Patterns of social interaction and access to political resources tend to differ significantly between rural and urban communities. Residents of rural communities tend to be more dependent on local interactional resources than do residents of urban communities. Urban residents tend to have greater access to different levels of government that have resources available to address local environmental problems. Interactional resources are a major means by which rural residents and local resources can be mobilized to address local problems. Social ties and/or conflicts which emerge can alter rural communities' social patterns and networks (social fabrics) far more than they can larger, urban communities' social patterns and networks.

Couch and Kroll-Smith concluded by noting that studies of community response to natural hazards had yielded different findings than this study of response to technological or industrial hazards. Far more was known about the effectiveness of different strategies for managing natural hazards than about different strategies for managing industrial hazards. The authors strongly recommended that hazard management strategies adopt measures that prevent social conflict and community breakdown as well as remedy social and cultural, not just environmental, adversities during recovery.

Wastes generated from the processing of cellulose and manufacture of pulp, paper, and other related goods can be highly toxic. Large quantities of these goods, particularly paper and pulp, have been produced. Several studies about the impacts of wastes generated from paper or pulp mills on North American waterways have been conducted (Adams et al. 1996; Campbell and Bettoli 1992; Chambers et al. 1997; Champoux 1996; Cleslek and Firth 1992; Couillard and Hodson 1996; Couillard et al. 1995; Dube and Culf 1996; Duff and Mcmillan 1997; Easton et al. 1997; Ehrlich et al. 1994; Forrest 1991; Gagnon et al. 1995; Harrel and McConnell 1995; Hontela et al. 1997; Huntley et al. 1994; Kenefick et al. 1994; Kenefick et al. 1995; Klinker and Wieland 1993; Kloepper-Sams and Benton 1994; Kloepper-Sams et al. 1994; Lowell et al. 1995; McKinney and Wade 1996; Mercaldo-Allen et al. 1994; Owens et al. 1994; Peterman and Delfino 1990; Prahacs et al. 1996; Raloff 1995; Renner 1995; Rogers et al. 1989; Servizi et al. 1988; Summers et al. 1991; Swanson et al. 1994; and Tozer 1994).

Paul Weaver (1994), a geographer, has addressed environmental policy issues related to the management of wastes generated from the production of paper and pulp. In 1990, the Food and Agricultural Organization of the United Nations predicted that by 1995 annual worldwide demand for paper/board production would be approximately 275 million tons. Environmental impacts brought about by cellulose production have included deforestation and disruption of forest ecosystems, depletion of non-renewable resources (including fossil fuels), and pollution of air, land, and water resources.

In 1991, research was conducted in France on the life cycle or flow of cellulose material from raw material (wood) input, through the production of paper and pulp, to the recycling of paper. Greater than three tons of wood and 40 tons of water as well as nearly 100 kilograms (kg.) of chemicals were required for production of one ton of pulp. Some of the chemicals were known to pose significant environmental or health risks. Each ton of manufactured pulp required about six kg. of sulfur and four kg. of chlorine.

Organic wastes were produced in the manufacture of paper and pulp. Although portions of the waste were recovered and later used, considerable quantities of liquid and solid organic waste were released into the environment. For each ton of paper released, approximately 54 kg. of sludge were released into waste waters. Research indicated that each ton of recycled paper would conserve nearly three tons of timber, 25 tons of water, and 82 kg. of chemicals; likewise, waste material generation would be greatly reduced if paper were recycled.

Increasingly, recycling of paper and other cellulose products was being advocated as a means of managing the aforementioned environmental problems. Weaver noted, however, that the top priorities were not to "save" trees or reduce the pulping industry's use of chemicals or release of pollutants. Rather, the main emphasis was on reducing quantities of disposed waste paper. Waste disposal at landfills, as mentioned earlier, had become a major environmental and political problem. Significant quantities of used paper goods were filling these sites. Recycling of paper was one way of reducing wastes disposed of in landfills.

Recycling prevents the dissipative release of contaminants contained in scrap paper and board into the environment. Contaminants have included chlorines and organachlorines (carcinogenic bleaching process residues) as well as heavy metals (contained within printing inks). At landfills, these contaminants have gradually leached into surrounding soils.

Weaver noted other significant findings. Many paper and pulp producing or cellulose processing facilities (like Buckeye Mill) have been geographically far removed from sites and places where the bulk of produced goods are used or consumed. Recycling entails transportation of scrapped goods back to production centers. Transportation between sites of consumption and production adds to environmental impacts. If chemicals used in paper and pulp production, conversion, and printing processes were replaced with safer, less toxic materials, then risks from leaching of decomposing goods, and thus perhaps incentives for recycling these goods, would be reduced.

Weaver discussed environmental policy implications of his findings. Determination of appropriate or optimal levels of product recycling can be complicated. Levels would vary according to relative location, type of good to be recycled, and particular environmental management objectives. As Weaver pointed out, however, a constraint on determining appropriate or optimal levels was that many different types of environmental impacts could not be compared using any single standard of measurements. He recommended addressing optimization in terms of specific environmental objectives (such as minimizing impacts on potential climatic change) to minimize complications.

Summary

It is apparent from this review that considerable research and knowledge about environmental hazards have accumulated. Much of this has addressed or has been based on studies of reactions to hazardous risks in general or to specific hazards that have threatened or impacted particular areas or communities. Although several studies have analyzed multiple types of risk from environmental hazards or different reactions to particular risks from hazards, very few studies have analyzed community reaction to very distinct types of hazards that pose potentially severe threats to those communities. Effective management of hazards threatening these communities requires knowledge of at-risk parties' perceptions of the hazards and attitudes toward different managerial policies. Taylor County offers an unusual opportunity to study an area recently impacted by industrial and natural hazards and an area with an economic livelihood tied heavily to the operation of an industrial hazard over which significant controversy has arisen and for which decisions with major implications are pending.

CHAPTER 3
HAZARDS IN TAYLOR COUNTY: PERSPECTIVE, RATIONALE, AND METHODOLOGY

Residents of Taylor County face risks from coastal storms (a natural hazard) and from pollutants emitted out of Buckeye Mill (an industrial or technological hazard). Extents to which households are threatened and/or have been adversely impacted by these hazards vary according to (among other factors) length and location of residency in the area.

A brief description of Taylor County and the aforementioned hazards that threaten the county follows. This includes discussion about the development and growth of Buckeye Mill, zoning and land use along the coastline of Taylor County, and measures taken in response to threats posed by Buckeye Mill and coastal storms. Other natural hazards posing potential risks are noted, as well. This is followed by a description of the methodology utilized in this study, including methods of data collection and subsequent analysis.

The Context

Taylor County is located in the northwestern corner of peninsular Florida along the Gulf of Mexico. The county is approximately 1,058 square miles in area and has a population (as of 1997) of around 18,500 people; the population density is approximately

17 people per square mile. Perry is the county's political seat and largest municipality, with a population approaching 7,500 people (Taylor County 1998).

Taylor County is a rural county with a manufacturing based economy. Nearly 40 percent of the county's labor force is employed in the manufacturing sector. Over 75 percent of the county is forested, primarily pine forest. The economy is heavily based on forest and wood resources. Two of the largest six employers in the county, including Buckeye Cellulose Corporation, are in the wood processing or lumber industry. Marine and fishing related products are another major source of employment in Taylor County (Chamber of Commerce 1997 and 1998).

Taylor County averages about one building per sixty acres of land. Industrial development is concentrated around the outer limits of the city of Perry. In 1993, the county's per capita income was around $13,690. The 1994 unemployment rate was 11.5% (Taylor County 1998).

The Taylor County coastline is approximately 45 miles in length and is primarily tidal marsh land. The vast majority of the coastline was placed in a conservancy and later purchased by the State of Florida; this land cannot be further developed. A small number of communities have been developed along the coastline, primarily along the southern half of the county's coastline. Although some coastal residents commute to Perry and other removed areas for employment, many residents rely on fishing or fishing-related activities as a major source of income.

The total water surface area in Taylor County is approximately 670,000 acres. This includes rivers, lakes, ponds, streams, and wetlands. Approximately 60,000 acres are marsh lands. The water tends to flow from the northeast towards the southwest across the county. Water flows through flood control canals in and around Perry and towards the Gulf of Mexico. Elevations across Taylor County average around 26 feet and range from sea level to about 90 feet above sea level (Taylor County 1998).

Buckeye Mill

The Buckeye cellulose-pulp plant is located along the Fenholloway River in Foley, approximately five miles southeast of the center of Perry. Construction of the plant was begun in 1952 and completed in 1954 on the site of a former lumber mill. Since that time, Buckeye Cellulose Corporation has been Taylor County's leading employer and source of income. Today, the corporation employs approximately 850 people and generates better than 1,000 additional jobs for independent contractors. Annual sales are around $300 million (Buckeye Mill 1997).

Annually, the corporation's operation converts about 2.5 million tons of slash pine into greater than 400,000 metric tons of cellulose. Pulp and cellulose are used to produce several commodities, including disposable diapers, filter papers, pharmaceuticals, rayon, sausage casings, and tires. The plant operates 24 hours per day, seven days per week.

The mill's location is heavily based on proximity to wood and water resources. As mentioned, greater than 75 percent of Taylor County is forested and the mill is located along the Fenholloway River. More than 50 million gallons of water is recovered daily from nearby underground springs and used in the production of goods. Significant levels of chemicals, including chlorine, are added to the water in the production process. The water with the added chemicals is subsequently drained into the Fenholloway River.

The Fenholloway River rises in San Pedro Bay, located northeast of the mill. The river flows along the south side of the mill and then towards the west to the south of Perry before turning and flowing south-southwest into an estuary and then into the Gulf of Mexico to the north of the majority of Taylor County's coastal communities. The point of discharge from the mill into the Fenholloway River is approximately 20 miles from the river's estuary and an additional 1.7 miles from the Gulf of Mexico. Since 1947, the Fenholloway River has been classified as a Class V, "Industrial Use," stream; this standard has allowed the mill to discharge wastes into the river (*Tampa Tribune* 12/16/94).

The operation of Buckeye Mill entails release or disposal of pollutants into the atmosphere, the Fenholloway River, and land storage waste facilities. According to the *Gainesville Sun*, November 23, 1995, in 1993, nearly 1.8 million pounds of pollutants were released, a decrease of seven percent from 1989 levels. Specific pollutants released in significant quantities included acetone, acetaldehyde, chlorine, chloroform, dioxin, formaldehyde, hydrochloric acid, methanol, methyl ethyl ketone, and sulfuric acid.

Although the mill is the main polluter of Florida's only industrially classified river, Buckeye Cellulose Corporation has undertaken several projects to alleviate environmental impacts from the mill's operation. In the mid 1960s, work began on a biological wastewater treatment plant. This and other subsequent improvements have reduced wastewater levels by greater than 90 percent. Chlorine use, which creates dioxins, has decreased appreciably since the late 1980s, and dioxin levels have been further reduced as a result of a major 1990 project. In the 1970s, scrubbers were installed to reduce particulate emissions into the atmosphere. Atmospheric sulfur emissions have been reduced by greater than 90 percent as a result of projects undertaken in the late 1980s. Despite these improvements, however, the Fenholloway River remains Florida's most polluted river and a highly noticeable odor persists over southern and eastern portions of Perry and the surrounding area.

Much of the present controversy began in the late 1980s when summer droughts temporally dried up the Fenholloway River except for discharge out of Buckeye Mill. Area residents near the river noticed a foul taste, odor, and color in water from their wells. In response to residents' complaints, municipal water lines were extended to homes along the river. Since then, many other area residents who have suspected problems with their water have received bottled water (*Gainesville Sun* 10/13/95).

Suspicions of water contamination have continued to emerge and have led to efforts to greatly reduce contaminant levels emitted in the mill's wastewater. Several proposals have been advocated by different local citizen groups; these have included installation of new, and sometimes costly, machinery or production technologies as well as measures to cut back or even cease operation of the mill. Differences have arisen between parties concerned about environmental and/or health impacts from the mill's operation and parties concerned about the mill's finances and operation as well as the area's economy.

In December 1994, after nearly three years of study by and negotiations between Florida's Department of Environmental Protection and Buckeye Cellulose Corporation, a plan to clean up the Fenholloway River was approved by the Florida Environmental Regulation Commission. The plan, which called for upgrading and reclassification of the river from a Class V, industrial use, to a Class III, fishable and swimmable, river was agreed upon by Buckeye officials, local residents, as well as locally elected officials and allowed the mill to remain in operation during the clean-up phase. The agreement did, however, stipulate that Buckeye Cellulose Corporation sign a legally binding schedule of completion that includes semi-annual progress reports. As a Class V river, the Fenholloway has been required to meet virtually no water quality standards. As a Class III river, the river will have to meet various state standards; if those standards are not met, polluters of the river can face legal action (*Tallahassee Democrat* 12/16/94).

The agreement entailed that Buckeye Mill's operation meet provisions of a Use Attainability Analysis and that the following three specific requirements be met: (1) decreased levels of chlorine used in processing in order to reduce emitted chlorinated organics by 40 percent; (2) injection of oxygen into plant effluent in order to increase oxygen levels in the river's water and help restore ecosystems; and (3) lightening of the color of emitted discharge by greater than 50 percent in order to allow increased sunlight penetration to the river bottom and help restore Gulf sea grasses. To help achieve these goals, the Department of Environmental Protection recommended construction of a pipeline to transport wastewater effluent directly from the mill to the Fenholloway River estuary (thus bypassing river channel flow) and that discharge from the pipeline be dispersed underwater. Further, Buckeye Cellulose Corporation would be required to restore some 7,000 acres of wetlands upstream of its plant where canals had been dug in the past to drain wetlands in order to increase and improve river flow and reduce durations of time during which the Fenholloway might go dry without input of the mill's wastewater (*Gainesville Sun* and *Tampa Tribune* 12/16/94).

A major issue of contention was the time frame over which these goals would be accomplished. Many local environmentalists and parties concerned about health related issues desired immediate reclassification of the river in order to limit the duration of the legally binding schedule of completion. Buckeye officials, on the other hand, sought a delayed date for reclassification in order to allow additional time to acquire necessary permits and to modify the mill's production process. Buckeye Cellulose Corporation received a three year extension, until December 31, 1997, on the date of river reclassification (*Tallahassee Democrat* 12/16/94 and 12/17/94).

Many people, including fishermen and coastal residents, have strongly opposed the proposed pipeline and have promised to fight it into the future. The proposal is believed by many of these people to be little more than the relocation of a major source of risk. Fear of ecological damage to the coastal marine ecosystem has been high among many residents, especially those who have depended on the ecosystem for part of their livelihood. Draft permits for the pipeline were issued by the State of Florida in 1997. Those permits were immediately challenged by fishermen and groups of Taylor County residents.

In 1995, the Department of Environmental Protection (DEP) decided to extend municipal water lines to a newly designated area of concern. Although DEP planned to cover the initial expenses, the department intended to attempt to divert the expenses to

Buckeye Cellulose Corporation by proving that wastewater had contaminated wells in the newly designated area. Buckeye officials, however, believed the area affected by contamination from river water was smaller than the area suspected by DEP officials. Despite this counterclaim, DEP officials decided to further expand the area into which water lines would be extended as both a 'goodwill' gesture and an added safety measure (*Gainesville Sun* 10/13/95).

The Coastal Tract of Taylor County

The Taylor County coastline stretches along the Gulf of Mexico from the Aucilla River in the northwest to the Steinhatchee River in the southeast. Approximately 3,000 people live in the county's coastal areas (Taylor County 1998).

Many residents livelihoods are directly linked to the coastal environment. Commercial and sport saltwater fishing are major means of livelihood. Likewise, freshwater fishing is popular along rivers draining into the Gulf of Mexico (Chamber of Commerce 1997 and 1998).

The majority of land along the Gulf of Mexico has, as was noted, been purchased by the State of Florida and is protected from further development. This covers approximately 100,000 acres of waterfront land. The communities of Adams Beach, Dekle Beach, and Keaton Beach are classified as Agricultural/Rural Residential areas. Steinhatchee is the most populated coastal community in Taylor County; part of the community has been designated as one of Taylor County's enterprise zones. A major purpose of the designation is promotion of private investment, economic revitalization and/or growth, as well as increased employment opportunities for area residents (Chamber of Commerce 1997 and 1998).

Taylor County officials have been actively promoting and enhancing coastal recreational opportunities through construction of offshore artificial reefs and public boat ramps. Taylor County is one of five Florida counties partaking in the Big Bend Artificial Reef Project funded by the Department of Environmental Protection. One of two reefs designated for Taylor County has been completed (Chamber of Commerce 1997).

The entire coastline of Taylor County is vulnerable to impacts from coastal storms. Most of the coastline is tidal marsh land, and all of the county's coastline lies within a hurricane flood zone that extends inland from two to eight miles. The major hazards posed by coastal storms are storm surge, high winds, and freshwater flooding from rain. Due to the relatively flat coastal geomorphology, storm surge potentials are especially severe.

> In Taylor County a Category 1 hurricane can produce a surge height of 10 feet above mean sea level; Categories 2 & 3, a 24 foot surge; and Categories 4 & 5, 34 feet above mean sea level. During a Category 5 hurricane, surge induced flooding can occur over 10 miles inland. (Taylor County 1998, p. 7)

Over the past century, Taylor County has been directly impacted by five hurricanes (tropical storms with sustained winds of at least 75 miles per hour and occurring during hurricane season, June 1 through November 30) (Taylor County 1998).

On March 12-13, 1993, the Taylor County coast was directly impacted by a winter storm (the aforementioned Storm of the Century). The entire county coastline was directly impacted by, on average, a twelve foot storm surge accompanied by four to six feet of wave action over a three hour period (the equivalent of a Category 1 hurricane). Ten people in the communities of Dekle Beach and Keaton Beach lost their lives as a result of the storm. Property damage estimates for Taylor County were approximately $2,000,000. A federal declaration was issued for costs of restoration and response; greater than $2,000,000 was allocated to the county (Taylor County 1998).

Damages from the storm were primarily due to winds and the eight to fourteen foot tidal surge along the coastline. Severe winds persisted from 3.5 to 4 hours. Precipitation levels were relatively low: Perry received 1.15 inches and Steinhatchee received 1.65 inches of rain. Of note is the fact that temperatures decreased from 85 degrees Fahrenheit to 20 degrees Fahrenheit over a 24 hour period. Taylor County experienced a severe freeze on the night of March 13, 1993 (Taylor County 1998).

Hurricane Josephine impacted the Big Bend area of Florida from October 8 to October 10, 1996. Winds impacting the coastline of Taylor County were, however, less than hurricane strength (sustained at least at 75 miles per hour) and did not cause severe damage. The county was, on the other hand, severely impacted by precipitation and subsequent flooding. Perry received 7.69 inches of rain from the storm and Steinhatchee received 5.04 inches. Unofficially, parts of the county received up to ten inches of precipitation. Total damages in Taylor County were estimated at $186,000 (Taylor County 1998).

Taylor County was impacted by Hurricane Opal in 1995. Although the storm made landfall over the western panhandle of Florida (150-200 miles west of Taylor County) and hurricane force winds did not impact the Taylor County coast, the county sustained greater than $100,000 (approximately $125,000) in damages. There was minor wind damage and major flooding (Taylor County 1998).

Inland Flooding and Other Natural Disasters in Taylor County

Much of interior Taylor County is low lying and many areas are highly vulnerable to inland flooding. The Aucilla, Econfina, Fenholloway, and Steinhatchee Rivers (from northwest to southeast) are the county's main rivers; all four rivers are sources of flooding during periods of intense precipitation. Nearly 300 people reside in inland floodprone areas along the Aucilla, Econfina, and Steinhatchee Rivers; nearly another 600 county residents live in other inland floodprone areas, primarily around Perry (Taylor County 1998).

Taylor County is vulnerable to other natural disasters, including forest fires, freezes, droughts, and sinkholes. Because, as noted, a vast majority of the county is timber land, forest fires pose a major hazard. Despite this, however, threats to populated areas are relatively insignificant. Generally, winter freezes do not pose severe risks and result in only minor crop damage to county farms. But if a major freeze were to occur (as happened in 1989 when temperatures remained below 32 degrees Fahrenheit for two days and reached as low as 17 degrees Fahrenheit), major crop damage could result. Likewise, although a major drought has not occurred in the county over the past several years, potential agricultural losses from a sustained drought could be severe. Although sinkholes periodically occur in Taylor County, they are generally small and thus far no injuries or fatalities have been attributed to sinkholes in Taylor County (Taylor County

1998).

There are more than 3,000 mobile homes in Taylor County. Because of threats from flooding, any mobile homes in floodprone areas must be elevated. Required heights of elevation vary at different sites according to potential flood levels. Because of storm surge potential, mobile homes in coastal floodprone areas must be elevated at least 17 feet (the highest minimal height requirement anywhere in Taylor County) off of the ground (Taylor County 1998).

Hazard-prone County

Taylor County residents are exposed to risks from industrial and natural hazards. In particular, parts of the county near the point of discharge from the Fenholloway River into the estuary and the Gulf of Mexico (especially if the proposed pipeline were to transport effluent directly from Buckeye Mill to the area) are significantly exposed to risks from both types of hazard. Although most of the county's coastline has been purchased by the State of Florida and is protected from development, individuals continue to reside in as well as develop and/or move into housing along exposed coastal lowlands.

Employees of Buckeye Mill and coastal residents have chosen to work and/or reside in locations directly exposed to hazards. In other words, they have voluntarily made decisions or taken actions which directly expose themselves to hazardous risks. Likewise, many residents of Taylor County believe they have involuntarily been exposed to pollution from Buckeye Mill.

Whereas impacts from coastal storms can be sudden, many impacts from the operation of Buckeye Mill have been cumulative and far more subtle. Residents of the immediate area have become accustomed to or tolerant of persistent odors and pollutants being constantly emitted during operation of the mill. In addition to pollution, the mill's operation impacts local forest ecosystems from which mass numbers of trees are routinely removed. Native forests have been converted into monocultured tree plantations.

Taylor County's economy relies heavily on a chemical industry which releases highly toxic dioxins into the surrounding environment. Highly sophisticated technology is utilized in the operation of Buckeye Mill. Modification or replacement of components of operation can be expensive and/or time consuming.

Several coastal residents rely on maritime resources (commercial and sport fishing as well as recreation and tourism) as major means of income. Other county residents value and/or utilize the coast for aesthetic and recreational purposes. The Gulf of Mexico is part of Taylor County's "backyard."

Management of Taylor County's hazards entails management and understanding of social, natural, and technological systems. Many of the related costs and benefits faced by parties exposed to these hazards are difficult to anticipate, recognize, measure, and compare or express in monetary or other equitable terms. Taylor County is one of Florida's poorer and more rural counties; employment opportunities in the county are relatively limited.

The majority of Buckeye Mill employees are permanent residents of Taylor County and are part of their communities' social fabrics. Proposals which entail closing down or significantly cutting back operation of the mill threaten already established patterns of behavior as well as the social fabric of communities in Taylor County.

County and State officials as well as other parties involved in early decision making processes overlooked many of the risks later to be associated with operation of Buckeye Mill. Today, those risks are a major concern. Likewise, actions proposed to be taken in response to the risks are a major source of concern. Many people are more willing to pay (through exposure to risk) to prevent loss of employment than to pay for improvement of the Fenholloway River (and ultimately for reduced exposure to risk). Their shorter-term fears of imminent loss of employment outweigh their longer-term fears of environmental degradation or adverse health.

Questions exist about levels of exposure to and adverse health effects from pollutants emitted out of Buckeye Mill. Although there is strong evidence that nearby well water has been contaminated, there is considerable uncertainty about degrees to which adverse health effects can be attributed to that contamination. These are sources of social dispute and disruption.

Strong public consent is lacking in regard to severities of risk from these hazards as well as about proposed management strategies for reducing those risks. Although many area residents have directly experienced adverse impacts from either or both of the aforementioned hazards, other residents of Taylor and surrounding counties have primarily been exposed to the hazards through media reports and other second hand accounts.

Several local public hearings addressing these hazards have influenced recent management decisions. Public pressures have led elected and appointed officials to try to reach compromising solutions. Many solutions advocated by technical experts have been strongly rejected by citizen groups. The proposed drainage pipeline was expected to alleviate many differences; the Fenholloway River water quality would be adequately upgraded without forcing the mill to cut back its operation. However, many citizens (including coastal residents) voiced immediate apprehension about the proposal and objected to continued emission of toxics into any of the county's waters.

Representatives of federal, state, and local governmental agencies have been responsible for major managerial decisions. Public trust in these officials' capacities to understand and effectively respond to and manage impacts from local storms or Buckeye Mill's operation has eroded. Many residents have been highly critical of officials' decisions and lack of understanding of local concerns. Disagreements have arisen over which particular agencies or levels of government ought to be allocated primary responsibility for resolving the aforementioned issues of concern. Blame for hazardous impacts and social disruption has been placed on government officials, Buckeye Mill officials, as well as outspoken citizen protestors.

Rationale for this Study

Effective management of hazards entails sound understanding of different component features of the hazards and of different individuals, relations, or systems threatened by the hazards. Studies which provide information about any of those aspects of hazards ought to greatly aide in the management of hazards.

Individuals are parts of communities. Different members of communities are involved in different ways and to different extents with other members of their communities. In order to understand an individual member's response to a particular hazard, it is necessary to understand his/her community; in order to understand a community's response to a hazard, it is necessary to have an understanding of individual members of the community.

The operation of Buckeye Mill and the coastal environment of Taylor County have benefited different communities of Taylor and surrounding counties in different ways and to different extents. Coastal storms and pollution from Buckeye Mill have impacted different communities of the region in different ways and to different extents. Therefore, it is likely that different residents' perceptions of and attitudes or responses toward those hazards and management of those hazards will vary. Risks and/or particular management policies or strategies deemed acceptable by some communities may not be deemed acceptable by other communities. This study will attempt to gain information about levels of variation between different communities' and different residents' perceptions of and attitudes toward hazards affecting Taylor County and surrounding areas. In particular, variations in response to various hazard management proposals will be analyzed.

The economic, social, and natural environments of Taylor County have been impacted in very different ways by coastal resources and storms and by the operation of Buckeye Mill. Assessment of risks from coastal storms and/or pollution emitted from Buckeye Mill ought to take into account economic, social, and environmental factors rather than be limited to technical analysis and expected numbers of fatalities. Many residents of the Taylor County region do not possess sufficient scientific expertise to fully comprehend technical aspects of the hazards or of ways to manage the hazards.

Risk management policy and decision making have been heavily influenced by public input. The public elects many officials involved in decision making processes and regularly attends (often in very large numbers) forums and other assemblies. Public values and attitudes affect political processes. Although measurement of public attitudes about the aforementioned hazards and interpretations of how those attitudes equate with overt behaviors can be problematic, if done effectively they can provide valuable information and insight for risk management. This study will attempt to provide this information and insight.

Whereas some studies have concluded that personal experience with or increased length of exposure to a particular hazard leads to decreased assessments of associated risks, other studies have found that personal experience with hazards leads to increased assessments of associated risks. Perceived probabilities of future recurrences of particular hazardous events have been found in some cases to increase and in other cases to decrease after the event has been experienced. This study will address these conflicting conclusions or findings.

Although the perceptions of many area residents have been greatly influenced by direct experience with coastal storms (especially coastal residents) or pollution out of Buckeye Mill (especially residents along the river downstream of Buckeye Mill), other residents perceptions of the risks have been influenced more by media and other second hand accounts than by direct experience with the hazards. Media accounts of the Buckeye Mill controversy and the storm of March 1993 (the "Storm of the Century") have tended to emphasize extreme impacts or reactions. Individuals whose perceptions are based heavily on such accounts may, in turn, overestimate risks associated with both hazards. Public debate and protest as well as delays in implementation of risk management policies have arisen (perhaps influenced by media reports) especially in regard to the Buckeye Mill controversy. These debates, protests, and delays have, in turn, been reported by media and may have fueled additional debate, protest, and/or delays in implementation.

Levels of exposure to hazardous risks vary spatially throughout the study region. Many hazardous substances are concentrated at Buckeye Mill; mill employees may very well have been exposed to far higher levels of these substances than other area residents. Although employees reside throughout the region (including outside of Taylor County), they constitute a greater proportion of the population of Perry and Taylor County than of other municipalities and counties. Many residents of the study area may recognize a regional risk from either or both of the aforementioned hazards but not believe that their own household or immediate neighborhood is at risk.

Although the area is classified as rural, there are heavily urbanized parts of the region. Perceptions and opinions of urban area residents and of rural area residents about risks and management of the hazard may vary. Some people, such as employees of Buckeye Mill and coastal residents, have voluntarily (perhaps unwittingly) exposed themselves to risks from hazards. Other people, such as residents of households along or near the Fenholloway River or in the immediate vicinity of the mill, have involuntarily been exposed to risks from hazards. Response to hazard management personnel, policy, and policy implementation has varied across the region. Local, state, and federal levels of government have been directly involved in different phases of hazard management; reactions to each level have varied. Pollution out of Buckeye Mill poses industrial risks; coastal storms pose natural risks. Variations in reactions of area residents to risks from both of the hazards may reflect different perceptions of and attitudes toward industrial hazard management and natural hazard management.

The natural and coastal environments of Taylor County and the surrounding area are utilized and valued for different reasons by different residents of the region. Impacts or threats to those environments ought to be assessed differently by different residents. An analysis of the perceptions, reactions, and opinions of residents of different parts of the region toward both hazards and of personal sociodemographic data from those residents ought to yield valuable information. Use of descriptors, including distance of residency from a hazard, length of exposure to a hazard, and degree of prior experience with or impact from a hazard, may greatly assist in future management of these hazards. A survey or 'revealed preference study' of area residents is a means by which relevant and informative materials can be obtained.

Research Tools

Much of the motivation to conduct this research resulted from a December 1994 study conducted in Taylor County in which a survey of residents' opinions about issues related to pollution from Buckeye Mill and to the March 1993 storm was administered. Reactions from many potential respondents as they were approached were surprisingly negative and/or confrontative. Unbeknownst at that time to this author was that the aforementioned public hearings related to reclassification of the Fenholloway River were being held and the degree of local controversy that surrounded those hearings. A large number of respondents expressed suspicion about the purpose of the survey and assumed that either an environmentally concerned interest group favoring closure of Buckeye Mill or an economic and industrially concerned interests group opposed to reclassification of the river was behind the survey. What became clear to this author was that a relatively small community was being engulfed by controversy emanating from an industrial hazard and response to risks associated with that hazard. Also of note was the fact the area had recently experienced major impacts from a severe natural disaster, the March 1993 "Storm of the Century." The interests of a high percentage of residents of Perry and coastal communities of Taylor County had been impacted by either or both of the hazards and stood to be potentially affected by upcoming decisions related to management of the hazards, especially pollution from Buckeye Mill. Because of what was perceived to be an unusually high level of concern (often emotionally expressed) about issues related to these local hazards, it was decided that the area presented a unique opportunity to gain insight into the perceptions and attitudes of people towards industrial and natural hazards.

Expressed preference surveys are a means by which people's perceptions and attitudes towards issues have been recorded. Although a revealed preference method of analysis was advocated by Chauncey Starr to be an effective means for uncovering information about public perceptions of and attitudes towards risk, it was believed in this case that an expressed preference survey would be more revealing because of on-going policy making procedures expected to go well into the future and the high level of controversy and newly emerging findings and attitudes that could heavily influence those procedures.

The revealed preference method of analysis assumes that hazard management policies which remain intact reflect socially acceptable levels of risk. Even if this assumption holds, policies reflect perceptions and attitudes of entire populations. It is unlikely, however, that the perceptions and attitudes of every member of a population conform exactly with provisions of intact policies. Expressed preference surveys, on the other hand, elicit responses from individuals and, in theory, ought to be a means by which differences between individual members of a population can be uncovered and analyzed. As noted, the Buckeye Mill controversy has spurred emotional and highly confrontative responses from different residents of the local area. The controversy poses a major threat to the community's social fabric. Risk management policy decisions have been greatly hampered by community dissension. Compromise has been and will continue to be a necessary part of the policy making process. It is unlikely that any particular management strategy can, by itself, truly reflect the attitudes of members of the affected population. Therefore this author believes an expressed preference survey would be an effective instrument for gaining information about Taylor County and the surrounding region's perceptions of and attitudes towards natural and man-made hazards.

Questionnaires were administered in an effort to collect data and information about individuals' backgrounds, prior experiences with hazards, perceptions of hazards, and attitudes toward proposals relevant to hazard management. In particular, an attempt was made to gather information about (1) respondents' childhood and current households and residential environments, (2) respondents' recent and past experience with risks and/or impacts from pollution or storms, (3) respondents' perceptions about industrial or man-made hazards and natural hazards, and (4) respondents' attitudes towards specific questions or proposals related Buckeye Mill, coastal storms, environmental protection, and economic growth. An effort will be made to determine relationships between personal background or prior experience with hazards and perceptions or attitudes about hazards and management of hazards.

Several hypotheses will be tested; these tests ought to reveal how strongly, if at all, individuals' perceptions of and attitudes towards hazards and hazard management (response or dependent variables) are related to one's personal background and prior experience with hazards.

Particular attention will be given to the following topics:

1. Comparisons of responses from residents of rural areas and residents of urban areas;

2. Comparisons of responses from individuals residing at different distances from Buckeye Mill and from the coast;

3. Comparisons of responses from residents of households with children and residents of households without children;

4. Comparisons of responses to questions or proposals addressing issues with environmental implications and questions or proposals addressing issues with economic implications;

5. Comparisons of responses from individuals whose residences or households have experienced damage from storms and/or problems with water quality and individuals whose residences or households have not experienced those impacts;

6. Comparisons of responses from longer-term coastal residents and shorter-term coastal residents; and

7. Comparisons of responses to questions addressing natural hazards and questions addressing industrial or man-made hazards.

Analytical Procedures

A 35-question survey was developed to be administered to residents of Perry, coastal Taylor County communities, county seat municipalities of each of four counties surrounding Taylor County, and Tallahassee. The population of Tallahassee is greater than ten times that of any other city of equal or less distance from Buckeye Mill or the Taylor County coast and the city was designated as the only urban area of residence to be surveyed. Survey questions were divided into four categories: personal or household demographics, perceptions of and/or attitudes about natural and man-made hazards in general, prior experience with hazards, and attitudes toward specific proposals concerning management of risks associated with Buckeye Mill, coastal storms, and economic development (Please see Appendix).

A pilot study was conducted in Perry during December 1996 to test and compare three different methods of survey: face-to-face meetings, telephone calls, and distribution of questionnaires to residences. A major purpose of this was determination of expected future response rates. Ironically, for each of the three survey methods, half (five out of ten) of the attempts to elicit responses were successful. However, it was discovered that many respondents were unaware of the distance from their residence to Buckeye Mill and/or to the coast. Therefore, it was decided that questionnaires would be distributed individually to residences and that distances from residences to Buckeye Mill and the coast would be determined and indicated on questionnaires before distribution. Further, because many respondents were unable or unwilling to take the time to complete the questionnaire at the time of distribution, it was decided that questionnaires would be distributed to those respondents and collected later (in most cases, returned by mail in a pre-stamped and addressed envelope distributed with the questionnaire).

Questionnaires were administered or distributed to and subsequently completed and returned by respondents during the summer and fall of 1997 in each of the following neighborhoods, communities, or municipalities: (1) Perry, to residences within five miles of Buckeye Mill and to residences between five and ten miles from Buckeye Mill; (2) the coastal Taylor County communities of Dekle Beach, Keaton Beach, and Steinhatchee as well as coastal sites between those communities; (3) the four adjacent (to Taylor County) county seats of Cross City (Dixie County), Madison (Madison County), Mayo (Lafayette County), and Monticello (Jefferson County); and (4) Tallahassee (in Leon County on the opposite side of Jefferson County from Taylor County and approximately 55 miles from Perry).

The majority of questionnaires were administered on weekdays between 8:00 A.M. and 6:00 P.M. or, in other words, during normal working hours. Consequently, persons not employed during those hours were more likely to have been approached than

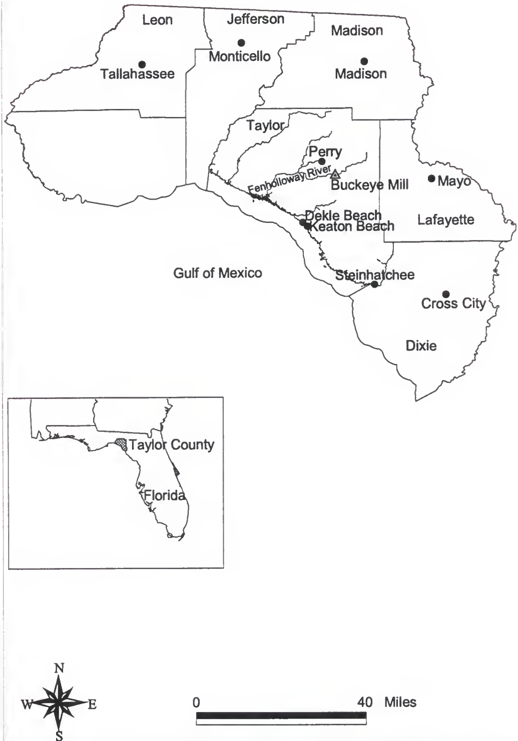

Figure 2. Study Region: Counties and Communities Surveyed

employed people. In all likelihood, this resulted in disproportionate numbers of female and retired residents receiving questionnaires.

Questionnaires were primarily distributed in residential and business zones of survey communities. Individuals employed in retail outlets were more likely to have been approached than were people employed by other establishments. Likewise, customers at retail outlets were more likely to have received questionnaires than were customers or clients of other businesses.

Several of the approached people expressed a reluctance or indicated a lack of sufficient time to complete a questionnaire. Questionnaires were not distributed to these individuals. It is noteworthy, as well, that although a vast majority of the area within the survey region is highly rural and sparsely populated, the bulk of questionnaires were distributed in county seats, the most populous municipalities within each of the counties.

As noted, respondents were asked about personal or household demographics, prior experience with hazards, as well as about their perceptions of and attitudes toward environmental hazards, in particular toward coastal storms and industrial pollution. As a measure of each individual's reactions towards hazards, each respondent was asked to indicate his/her level of support for or opposition towards (strongly support, somewhat support, indifferent, somewhat oppose, strongly oppose) proposals related to management of risks associated with coastal storms and pollution of the Fenholloway River from Buckeye Mill. Each respondent was asked about his/her level of concern and/or fear of (high, somewhat, none) natural hazards and of industrial hazards as well as about the manageability of environmental hazards (yes, no, or unsure that they can be managed).

Attempts were made to elicit honest responses from survey subjects as well as to convey a neutral attitude by survey administrators toward Buckeye Mill's operation and development of coastal or other environmentally sensitive or hazard prone areas. A cover letter that specifically noted costs and benefits attributable to Buckeye Mill's operation and residential development of the Taylor County coast accompanied each questionnaire. Respondents were actively encouraged to freely express themselves and, if desired, were able to complete the questionnaire in privacy and then to anonymously return it via mail.

Soon after questionnaires began to be administered in Perry, at least one concerned resident forwarded a copy of the cover letter and questionnaire to Buckeye Mill. Buckeye Mill's public relations specialist, Dan Simmons, contacted this author's office in Tallahassee and expressed serious concern about this study. Mr. Simmons was assured that the study was not being conducted by parties opposed to Buckeye Mill's operation.

On three separate occasions, law enforcement personnel approached surveyors as questionnaires were being administered. In Mayo, an approaching officer insisted because of "the controversial nature" of the questionnaires that administration be immediately ceased and that any other questionnaires needing response be left at law enforcement headquarters. Because of a need for all respondents to be local residents and for samples of respondents to be representative of their community, it was decided that questionnaires would not be left at the station. The officer had apparently been notified by a resident approached earlier that day by a survey taker. On two occasions in Perry, surveyors were approached by police officers expressing concern about the surveyors' presence in residential neighborhoods. When informed of the purpose of the survey taking, the officers allowed it to continue in the neighborhood.

Several hypotheses related to perceptions of and attitudes toward environmental hazards have been tested. These can be divided into seven categories.

Residential Environment

Each respondent's current residence was classified as rural or urban (independent variable). Residents of Tallahassee and of each of the four county seats adjacent to Taylor County live greater than ten miles from Buckeye Mill. The responses from residents of Tallahassee (an urban area) to questions or proposals related to pollution of the Fenholloway River and to industrial hazards (dependent or response variable) were compared to the responses from residents of the four county seats surrounding Taylor County (all rural areas). Because residents of Taylor County live closer to and are generally more affected by the operation of Buckeye Mill than are residents outside of Taylor County, it was decided that only non-Taylor County residents' responses would be compared.

Responses from residents of Tallahassee on issues related to natural hazards and coastal development or protection (dependent or response variable) were compared to responses from residents of Madison, Mayo, and Monticello. Tallahassee and these three municipalities are each more than twenty miles from the coast. Because Cross City and each of the Taylor County survey sites are within twenty miles of the coast, it was decided that responses from individuals of these communities would not be included.

Responses from residents of Tallahassee to questions about environmental hazards in general (dependent or response variable) were compared to responses from residents of all of the remaining survey sites.

In each of these three cases, the following hypothesis has been tested: the perceptions and attitudes of residents of urban areas (Tallahassee) ought to differ from the perceptions and attitudes of residents of rural areas.

Spatial Difference Between One's Residence and Hazards

As noted, distances between each respondent's residence and both Buckeye Mill and the coast were recorded (independent variables). Comparisons have been made between responses to questions on natural hazards in general and proposals on management and protection or future construction and development of coastal areas (dependent or response variable) from individuals residing less than 10 miles from the coast, individuals residing between 10 and 20 miles from the coast, and individuals residing further than 20 miles from the coast (independent variable). Likewise, comparisons were made between responses to issues on industrial hazards in general and proposals on management of pollution and clean up of the Fenholloway River (dependent or response variable) from individuals residing less than five miles from Buckeye Mill, individuals residing between five and ten miles from Buckeye Mill, and individuals residing further than ten miles from the mill (independent variable).

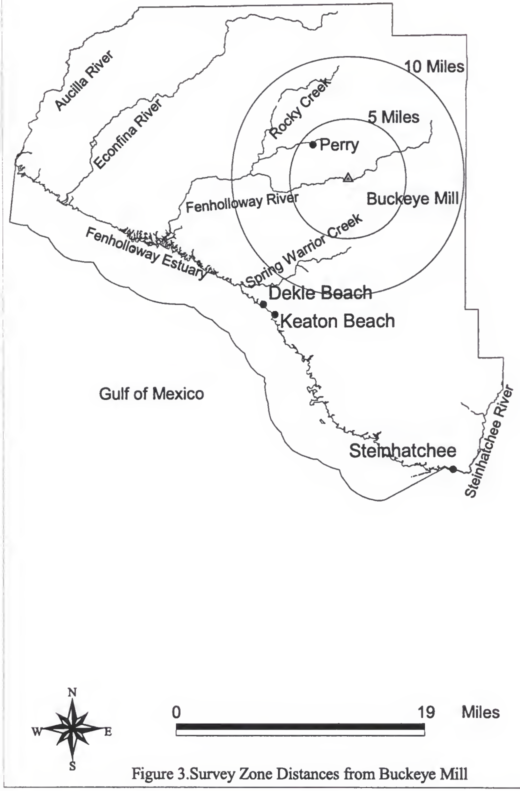

Figure 3.Survey Zone Distances from Buckeye Mill

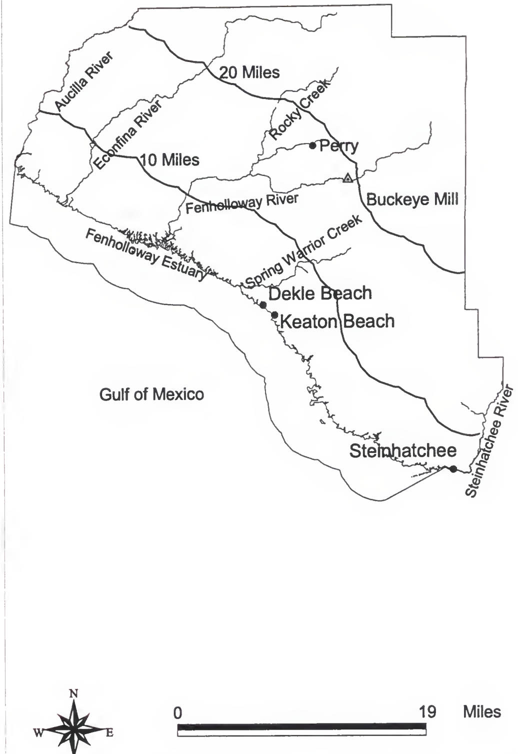

Figure 4.Survey Zone Distances from the Taylor County Coastline

For both cases, the following hypothesis has been tested: the perceptions and attitudes toward risks associated with environmental hazards ought to vary between parties residing at different distances from those hazards.

Presence of Children in a Household

Each respondent was asked to indicate the number of children (under 18 years of age) residing in his/her household (independent variable). Distances between each respondent's residence and both Buckeye Mill (less than 5 miles, 5-10 miles, or greater than 10 miles) and the coastline (less than 10 miles, 10-20 miles, or greater than 20 miles) were recorded (independent variables). A decision was made to separately test hypotheses for respondents living within five miles of Buckeye Mill, for those living within ten miles of the coast, as well as for those living beyond these distances from each of the hazard zones. It was also decided that responses from only residents of rural areas would be included.

Responses from residents of households with children to questions on industrial hazards in general and to proposals addressing clean up of the Fenholloway River (dependent or response variable) as well as to questions on natural hazards in general and to proposals addressing management and protection or future construction and development of coastal areas (dependent or response variable) have been compared to responses from residents of households without children.

For each of four cases (residence within and residence beyond five miles of Buckeye Mill as well as residence within and residence beyond ten miles of the coast) the following hypothesis has been tested: the perceptions and attitudes of residents of households with children ought to differ from the perceptions and attitudes of residents of households without children.

Economic Concerns vs Environmental Concerns

Whereas some of the survey questions or proposals have major environmental implications, other questions or proposals have major economic implications. Respondents residing within five miles of Buckeye Mill or within ten miles of the coast face major risks from pollution out of Buckeye Mill or from coastal storms. Environmental and financial resources have been and will continue to be impacted to different extents by hazardous events and by alternative management strategies and proposals, including those responded to in this survey. Comparisons were made between individuals' responses to environmentally related questions or proposals and their responses to financially related questions or proposals (response variables). Responses from respondents residing within ten miles of the coast to questions or proposals addressing economic aspects and environmental aspects of coastal storm hazards and management have been compared; responses from respondents residing within five miles of Buckeye Mill to questions or proposals addressing economic aspects and environmental aspects of industrial hazards and management have been compared.

In both of those cases, the following hypothesis has been tested: perceptions and attitudes about environmentally related questions and proposals ought to differ from perceptions and attitudes about economically related proposals.

Personal Exposure vs Media Exposure

Respondents were asked if they, their household, or their residence had experienced problems with water quality (including due to pollution from Buckeye Mill) or damage from storms or other natural hazards (including from the March 1993 storm and/or Hurricane Josephine) (independent variables). It is expected that individuals responding positively to these questions are more apt than others to base their perceptions of and attitudes toward environmental hazards on personal experience and direct exposure to risks associated with those hazards; it is expected, as well, that individuals who have not been directly exposed to hazards are more apt than those who have been exposed to base their perceptions and attitudes on media and other second-hand accounts of environmental hazards. Responses to questions or proposals related to coastal storm hazard management (dependent or response variable) from individuals who responded positively to questions about prior experience with or impact from natural hazards have been compared to the responses of others. Likewise, responses to questions or proposals related to pollution or industrial hazard management (dependent or response variable) from people who responded positively to questions about prior experience with or impact from poor water quality have been compared to the responses of others.

In both of these cases, the following hypothesis has been tested: the perceptions and attitudes of individuals who have directly experienced risks and/or adverse impacts from environmental hazards ought to differ from the perceptions and attitudes of those who have not experienced those risks and/or adverse impacts.

Length of Coastal Residency

Respondents living along the Taylor Coast were asked to indicate the number of years they had resided along the coast (independent variable). As noted in Chapter 2 and expected in this study, perceptions and attitudes about coastal storm hazards and risks among longer-term coastal residents differ from the perceptions and attitudes of shorter-term coastal residents. Comparisons were made between longer-term and shorter-term coastal residents' responses to questions related to personal fear and/or concern about coastal storms or natural hazards (dependent or response variable).

The following hypothesis has been tested: the perceptions and attitudes of individuals who have resided along the Taylor County coast for relatively long periods ought to differ from the perceptions and attitudes of those who have resided along the coast for relatively short periods.

Natural Hazards vs Industrial (Human-made) Hazards

Respondents were surveyed about natural hazards, including coastal storms, and about industrial hazards, including pollution. Many have been impacted to different extents and in different ways by risks from pollution and storms and will be impacted in different ways by alternative risk management practices. Individuals residing within five miles of Buckeye Mill (and therefore more than 10 miles from the coast) may, on average, face greater risks from pollution out of Buckeye Mill than from coastal storms; individuals residing along the coast (and therefore more than 15 miles from Buckeye

Mill) may on average face greater risks from coastal storms than from discharge out of Buckeye Mill. Residents of other parts of the survey region face varied levels of risk (in soma cases perhaps minimal or no risk) from these hazards. Respondents from all parts of the region have been impacted to different extents and in different ways throughout their lives by pollution or industrial hazards and storms or natural hazards. Responses to questions or proposals related to storms and natural hazards (response variable) have been compared to responses to questions or proposals related to pollution and industrial or man-made hazards for each of the following groups: those residing within ten miles of the coast, those residing within five miles of Buckeye Mill, and those residing further than ten miles from the coast and further than five miles from Buckeye Mill.

In all three cases, the following hypothesis has been tested: individuals' perceptions of and attitudes toward natural hazards and management of those hazards ought to differ from their perceptions of and attitudes toward industrial or man-made hazards and management of those hazards.

Additional independent variables for which data has been collected include:

1. Childhood residential environment: Rural or Urban;
2. Present type of employment and Childhood household's type of employment: Recovery, production, and processing of natural resources (environmentally exploitative) or Other;
3. Age: 50 and younger or Older than 50;
4. Sex: Female or Male;
5. Annual Household Income: Less than $20,000 or $20,000-$50,000 or Greater than $50,000; and
6. Education: High school and below or At least some college.

Specific response variables or dependent variables which will be analyzed and are assumed to reflect individuals' perceptions of and attitudes towards environmental hazards can be separated into three categories.

1. Concerns, fears, and/or beliefs about environmental hazards and management of the hazards:

Respondents were asked to what extent they are concerned about and/or fearful of (A) natural hazards in general and (B) industrial or man-made hazards in general (highly or somewhat or neither). Respondents also were asked if they believed environmental hazards were manageable (yes or unsure or no).

2. Questions or proposals related to cleanup of the Fenholloway River and management of Buckeye Mill as well as to permits for future industry: Respondents were asked to what extent they favor or support (A) clean up of the Fenholloway River, (B) clean up of the Fenholloway River through increased taxation, (C) clean up of the Fenholloway River through closure of Buckeye Mill, and (D) requirements that future proposed businesses or industries demonstrate they are environmentally safe before any permit be issued (highly support or somewhat support or indifferent or somewhat oppose or highly oppose).

3. Questions or proposals related to development, utilization, and protection of coastal environments: Respondents were asked to what extent they favor or support (A) coastal property owners' loss of eligibility for federal or state supported financial assistance for recovery from damages due to storms; (B) strengthened building codes for

any future coastal construction; (C) prohibition of future coastal development; (D) purchasing of undeveloped coastal lands and environmentally sensitive areas with taxpayers' money; and (E) the proposed pipeline to the coast from Buckeye Mill (highly support or somewhat support or indifferent or somewhat oppose or highly oppose).

Statistical Tests

The dependent or response variable for each of the hypotheses to be tested is qualitative and has been ranked ordinally; therefore non-parametric tests were performed. For a majority of the six categories of hypotheses to be tested (Categories I, III, V, and VI), comparisons were made between the responses of two different populations (samples) to the same questions and proposals. For two of the six categories (Categories IV and VII), comparisons have been made between each individual's responses to two different groups of questions and proposals. For the remaining category (Category II), comparisons were made between the responses of three different populations to the same questions and proposals. For each of these three differing methods of comparison, a different but related statistical test has been performed.

The Mann-Whitney U Test and the Wilcoxon Rank Sum Test are equivalent to one another and are the most commonly used test when qualitative, ordinally ranked response (dependent) variables are compared between two different populations. The tests require neither equal sample sizes from each population nor an assumption of a normal frequency distribution of response variables among respondent populations. (Marks 1982 and Ott 1993). This statistical test was used to test hypotheses from the four categories for which comparisons have been made between two different populations' responses to identical questions and proposals.

The Wilcoxon Matched Pairs Signed-Rank Test, an altered form of the Wilcoxon Rank Sum Test, is commonly used to compare different responses from the same individuals. Magnitudes of differences between ordinally ranked responses to different questions and proposals are the basis of statistical comparison (Marks 1982 and Ott 1993). This statistical test was used to test hypotheses from the two categories for which comparisons have been made between each individual's responses to two different groups of questions and proposals.

The Kruskal-Wallis Test can be used when comparing qualitative, ordinally ranked responses from more than two different populations. When applied to comparisons of responses from two different populations, the Kruskal-Wallis Test reduces to the Wilcoxon Rank Sum Test. As with the other, aforementioned, tests, the Kruskal-Wallis Test neither requires equal sample sizes from each population nor assumes a normal frequency distribution of the response variable among the sampled populations (Hollander and Wolf 1973, Marks 1982, and Ott 1993). This statistical test was used to test hypotheses from the category for which comparisons have been made between three different populations' responses to identical questions and proposals.

CHAPTER 4
RESULTS OF THE SURVEY

Descriptive Statistics

A total of 368 questionnaires were responded to by residents of the region. In some cases, subjects did not respond to every question or proposal. Two of the 32 questions or proposals were directed only towards coastal residents: (1) length of coastal residency in Taylor County and (2) level of support towards the proposed pipeline from Buckeye Mill to the Fenholloway River--Gulf of Mexico estuary. Table 4-1 lists the primary statistics for each of the 24 questions or proposals utilized in the hypotheses tests: (1) the number of subjects responding, (2) the mean (average) response, (3) the modal (most frequent) response, and (4) the standard deviation (average level of dispersion) of the responses given by all subjects.

Table 4-1 Hypothesis Test Data Statistics

Question or proposal	**Number**	**Mean**	**Mode**	**Standard Deviation**
1. Present Residence	351	2.4160	2.0	0.8129
2. Number of children in household	339	0.7404	0.0	1.0758
3. Distance: residence to Buckeye Mill	351	2.0427	1.0	1.5328
4. Distance: residence to coast	351	2.5100	1.0	1.4772
5. Length of coastal residency	52	13.5385	10.0	13.3335
6. Concern/fear about natural hazards	349	3.0745	3.0	1.1770
7. Concern/fear about industrial hazards	347	3.5879	3.0	1.3081
8. Concern/fear about industrial hazards vs concern/fear about natural hazards	310	3.5935	5.0	1.3967

Table 4-1 Hypothesis Test Data Statistics continued

9. Buckeye Mill's impacts on household's water quality and health	350	1.6057	1.0	1.1525
10. Any impacts on residence's water quality	346	1.9191	1.0	1.4363
11. Prior impact on water quality of any residence	346	2.4509	1.0	1.8111
12. Damage: March 1993 storm or Hurricane Josephine	349	2.1175	1.0	1.7155
13. Storm damage: current residence	347	2.2565	1.0	1.7767
14. Prior damage to any residence from storms	350	3.2171	5.0	1.9503
15. Clean up of Fenholloway River	349	4.3209	5.0	0.9680
16. Clean up of river through increased taxes	344	3.0814	4.0	1.5250
17. Clean up of river if Buckeye Mill closes	343	2.5860	1.0	1.4582
18. Lose government aid for recovery from storms	345	2.7362	1.0	1.6112
19. Strengthen coastal building codes	345	4.0551	5.0	1.3250
20. Prohibit future coastal development	346	2.9046	4.0	1.4405
21. State purchase of land	347	3.2767	5.0	1.5105
22. Environmental prerequisites for industry	346	4.2197	5.0	1.1077
23. Proposed pipeline from Buckeye Mill to coast	58	4.4138	5.0	1.1087
24. Manageability of environmental hazards	346	1.9162	1.0	1.2770

Note for Table 1: (A) For Row 1: Rural=2 and Urban=4; (B) For Row 3: Greater than ten miles=1, Five to ten miles=3, and Less than five miles=5; (C) For Row 4: Greater than 20 miles=1, 10 to 20 miles=3, and Less than 10 miles=5; (D) For Rows 6 and 7: Neither concerned nor fearful=1, Somewhat concerned or fearful=3, and Highly concerned or fearful=5; (E) For Row 8: Concern or fear about the impacts of natural forces on human activity=1, Equal levels of concern or fear=3, and Concern or fear about the impacts of human activity on the natural environment=5; (F) For Rows 9, 10, 11, 12, 13, and 14: No=1, Unsure=3, and Yes=5; (G) For Rows 15, 16, 17, 18, 19, 20, 21, and 22: Strongly oppose=1, Somewhat oppose=2, Indifferent=3; Somewhat support=4, and Strongly support=5; (H) For Row 23: Strongly support=1, Somewhat support=2, Indifferent=3, Somewhat oppose=4, and Strongly oppose=5; and (I) For Row 24: Yes=1, Unsure=3, and No=5. Also, please see Appendix: Survey Questionnaire.

Hypothesis Tests

Seven categories of hypotheses have been tested. For each category, one to four tests were conducted. Each test analysis includes a statistical table (Tables 2-18). Five of the tables (Tables 11, 12, 16, 17, and 18) are accompanied by explanations. For the remaining 12 tables: each value of the independent variable (please see note at the end of Table 1) is listed in the left hand column, the frequency (number of respondents) of each of those values is listed in the middle column, and the mean rank of the responses given by each of the groups of respondents (one group per value of each independent variable) is listed in the right column. The higher the mean rank for a specific value of an independent variable, the greater the level of concern/fear about hazards expressed by that group of respondents. The significance level of each test is included in the lower portion of each table. The lower a significance level, the more statistically significant the hypothesis test.

Category I: Residential Environment

Responses from residents of Tallahassee (classified as an urban area) have been compared to responses from residents of other survey sites (classified as rural areas). In each case, it has been hypothesized that the perceptions and attitudes of urban area residents ought to differ from the perceptions and attitudes of residents of rural areas.

Industrial or human-made hazards

Responses to questions or proposals related to clean up of the Fenholloway River and management of Buckeye Mill, to permits for future development of industry, as well as to environmental impacts of human activity have been analyzed. Responses from residents of Tallahassee were compared to the responses from residents of each of the four counties surrounding Taylor County.

H0: The perceptions and attitudes of residents of urban areas on issues related to industrial or human-made hazards do not differ from the perceptions and attitudes of residents of rural areas.

H1: The perceptions and attitudes of residents of urban areas on issues related to industrial or human-made hazards differ from the perceptions and attitudes of residents of rural areas.

Table 4-2

Residential Environment	**Frequency**	**Mean Rank**
Rural	145	97.69
Urban	69	128.12
Significance Level:	0.001	

Statistical analysis indicated that responses from residents of Tallahassee were significantly different (at the .10, .05, and .01 levels) from the responses of residents of Dixie, Jefferson, Lafayette, and Jefferson Counties. As hypothesized, Tallahassee residents were more supportive of efforts to clean up the Fenholloway River and/or more concerned about the impacts of human activity on the natural environment than were residents of the four counties surrounding Taylor County.

Natural hazards and the coastal environment

Responses to questions or proposals related to the development, utilization, and protection of coastal areas as well as to concern about natural forces have been analyzed. Responses from residents of Tallahassee were compared to responses from residents of the three inland county seats (greater than 20 miles from the coast) surrounding Taylor County.

H0: The perceptions and attitudes of residents of urban areas on issues related to natural hazards do not differ from the perceptions and attitudes of residents of rural areas.

H1: The perceptions and attitudes of residents of urban areas on issues related to natural hazards differ from the perceptions and attitudes of residents of rural areas.

Table 4-3

Residential Environment	**Frequency**	**Mean Rank**
Rural	73	62.53
Urban	71	82.75
Significance Level:	0.003	

Views expressed by residents of Tallahassee differed significantly (at the .10, .05, and .01 levels) from those expressed by the residents of Jefferson, Lafayette, and Madison Counties. Residents of Tallahassee were more supportive of protection of and limited development on coastal environments and/or more concerned about natural hazards than were residents of the other three counties.

Of note is the fact that although both tests revealed significant differences between the perceptions and attitudes of residents of urban areas and those of rural area residents, the differences were greater for issues related to industrial hazards (the former hypothesis test topic) than for issues related to natural hazards (the latter hypothesis test topic).

Environmental hazards in general

Responses to questions related to concern about and/or fear of natural hazards and of industrial hazards as well as to the manageability of those hazards have been analyzed, again, comparing the responses from residents of Tallahassee with those from residents of each of the other survey sites, including sites in Taylor County.

H0: Urban area residents' perceptions of and attitudes toward environmental hazards do not differ from the perceptions and attitudes of rural area residents.

H1: Urban area residents' perceptions of and attitudes toward environmental hazards differ from the perceptions and attitudes of rural area residents.

Table 4-4

Residential Environment	**Frequency**	**Mean Rank**
Rural	272	168.08
Urban	71	187.00
Significance Level:	0.138	

Results indicated that responses from Tallahassee residents did not significantly differ from the responses of residents of the other survey sites. (If tested at the .15 level of significance, the results would have been significantly different). Despite this, respondents from Tallahassee were somewhat more concerned about environmental hazards and the manageability of those hazards than were respondents from rural areas.

When Taylor County sites were included among the rural area survey sites in the data analysis, differences between perceptions and attitudes of urban residents versus perceptions and attitudes of rural residents were less significant than when responses from residents of Taylor County were not included in the analysis. This raises a question concerning the pertinence of proximity to areas at risk from hazards. Could the fact that respondents from Taylor County live in closer proximity to the hazards about which they were surveyed than do respondents from the other rural survey sites have affected the results? Comparisons of responses from individuals residing different distances from Buckeye Mill and the coast could help answer this question.

Category II: Spatial Distance Between One's Residence and Hazards

Responses from individuals residing at different distances from Buckeye Mill (an industrial hazard) and different distances from the coast (an area exposed to natural hazards) have been compared. In each case, it has been hypothesized that perceptions of and attitudes towards environmental hazards vary with the distance between one's residence and sites exposed to the hazards in question.

Industrial or human-made hazards

Responses to questions or proposals related to clean up of the Fenholloway River and management of Buckeye Mill, to permits for future industry, and to the impacts of human activity on nature have been analyzed. Responses from individuals residing within five miles of Buckeye Mill, individuals living five to ten miles from the mill, and from individuals residing greater than ten miles from Buckeye Mill were compared.

H0: Perceptions of and attitudes toward risks associated with Buckeye Mill and industry in general do not differ between individuals residing within five miles of Buckeye Mill, individuals living five to ten miles from the mill, and individuals living further than ten miles from the mill.

H1: Perceptions of and attitudes toward risks associated with Buckeye Mill and industry in general differ between individuals residing within five miles of Buckeye Mill, individuals living five to ten miles from the mill, and individuals living further than ten miles from the mill.

Table 4-5

Distance from residence to Buckeye Mill	**Frequency**	**Mean Rank**
Less then five miles	57	122.10
Five to ten miles	61	144.45
More than ten miles	214	184.61
Significance Level:	0.000	

Responses varied significantly (at the .10, .05, and .01 levels) between the three different groups. Respondents living within five miles of Buckeye Mill expressed the lowest levels of concern about risks from Buckeye Mill and industry in general, and respondents living further than ten miles from the mill expressed the greatest levels of concern about those risks.

Natural hazards and the coastal environment

Responses to questions or proposals related to development, utilization, and protection of coastal areas as well as to concern about natural forces have been analyzed. Responses from individuals living within ten miles of the coast, individuals residing ten to twenty miles from the coast, as well as from individuals living further than twenty miles from the coast were compared.

H0: Perceptions of and attitudes toward risks associated with coastal storms and natural hazards in general do not differ between individuals living within ten miles of the coast, individuals residing ten to twenty miles from the coast, and individuals living further than twenty miles from the coast.

H1: Perceptions of and attitudes toward risks associated with coastal storms and natural hazards in general differ between individuals living within ten miles of the coast, individuals residing ten to twenty miles from the coast, and individuals living further than twenty miles from the coast.

Table 4-6

Distance from residence to coast	**Frequency**	**Mean Rank**
Less than ten miles	63	133.86
Ten to twenty miles	128	161.84
More than twenty miles	144	188.42
Significance Level	0.001	

Perceptions and attitudes varied significantly (at the .10, .05, and .01 levels) between the three groups of respondents. Contrary to expectations, individuals living within ten miles of the coast were the least concerned of the three groups about risks from coastal storms and natural hazards in general; individuals living further than twenty miles from the coast were the most concerned about the risks from those hazards.

Although both of these tests indicated significant variation in perceptions of and attitudes toward risks associated with environmental hazards between individuals residing different distances from areas especially vulnerable to impact, the variation was slightly more significant with distance from Buckeye Mill than with distance from the coast.

Category III: Presence of Children in a Household

Responses from residents of rural areas at different distances away from Buckeye Mill and from the coast have been analyzed. For each of four cases, responses from individuals living in households without children have been compared to responses from individuals living in households with children. In each of these cases, it has been hypothesized that the perceptions and attitudes of residents of households with children differ from the perceptions and attitudes of residents of households without children.

Industrial or human-made hazards

Responses to questions or proposals related to clean up of the Fenholloway River and management of Buckeye Mill, to permits for future industry, and to the impacts of human activity on the natural environment have been analyzed.

a) Case 1: Respondents living less than five miles from Buckeye Mill

Responses from individuals residing within five miles of Buckeye Mill in households with children have been compared to responses from individuals residing less than five miles from the mill in households without children.

H0: Perceptions of and attitudes toward risks associated with Buckeye Mill and industry in general do not differ between individuals residing less than five miles from Buckeye Mill in households with children and individuals living within five miles of the mill in households without children.

H1: Perceptions of and attitudes toward risks associated with Buckeye Mill and industry in general differ between individuals residing less than five miles from Buckeye Mill in households with children and individuals living less than five miles from the mill in households without children.

Table 4-7

Children in household	**Frequency**	**Mean Rank**
No	32	27.45
Yes	24	29.90
Significance Level:	0.578	

The perceptions and attitudes of individuals living in households with children did not significantly differ from the perceptions and attitudes of individuals living in households without children. On average, respondents from households with children expressed slightly more concern about the risks than did respondents from households without children.

b) Case 2: Respondents living at least five miles from Buckeye Mill

Responses from persons living at least five miles from Buckeye Mill in households with children have been compared to responses from persons living at least five miles from Buckeye Mill in households without children.

H0: Perceptions of and attitudes toward risks associated with Buckeye Mill and industry in general do not differ between individuals living at least five miles from Buckeye Mill in households with children and individuals living at least five miles from the mill in households without children.

H1: Perceptions of and attitudes toward risks associated with Buckeye Mill and industry in general differ between individuals living at least five miles from Buckeye Mill in households with children and individuals living at least five miles from the mill in households without children.

Table 4-8

Children in household	**Frequency**	**Mean Rank**
No	117	96.85
Yes	82	104.50
Significance Level:	0.354	

Responses from residents of households with children did not differ significantly from those of people residing in households without children. As was the case for respondents living within five miles of Buckeye Mill, individuals from households with children expressed slightly greater concern about the risks than did respondents from households without children. Although neither difference in level of concern was significant, the difference was greater between respondents living at least five miles from the mill than between respondents living within five miles of the mill.

Natural hazards and the coastal environment

Responses to questions or proposals related to development, utilization, and protection of coastal areas as well as to concern about natural forces have been reviewed.

a) Case 1: Respondents residing within ten miles of the coast

Responses from individuals residing within ten miles of the coast in households with children have been compared to responses from individuals residing within ten miles of the coast in households without children.

H0: Perceptions of and attitudes toward risks associated with coastal storms and natural hazards in general do not differ between individuals residing less than ten miles from the coast in households with children and individuals residing less than ten miles from the coast in households without children.

H1: Perceptions of and attitudes toward risks associated with coastal storms and natural hazards in general differ between individuals residing less than ten miles from the coast in households with children and individuals residing less than ten miles from the coast in households without children.

Table 4-9

Children in household	**Frequency**	**Mean Rank**
No	45	31.17
Yes	16	30.53
Significance Level:	0.902	

As in previous cases, the perceptions and attitudes of individuals from households with children were not significantly different from the perceptions and attitudes of individuals from households without children. Respondents from households without children expressed a minimally greater amount of concern than did respondents from households with children.

b) Case 2: Respondents residing at least ten miles from the coast

Responses from people in households with children living at least ten miles from the coast children have been compared to responses from people residing at least ten miles from the coast in households without children.

H0: Perceptions of and attitudes toward risks associated with coastal storms and natural hazards in general do not differ between people living at least ten miles from the coast in households with children and people living at least ten miles from the coast in households without children.

H1: Perceptions of and attitudes toward risks associated with coastal storms and natural hazards in general differ between people living at least ten miles from the coast in households with children and people living at least ten miles from the coast in households without children.

Table 4-10

Children in household	**Frequency**	**Mean Rank**
No	123	105.61
Yes	82	99.09
Significance Level:	0.439	

The perceptions and attitudes of respondents from households with children again were found not to significantly differ from those of respondents from households without children. Like respondents residing within ten miles of the coast, greater concern about risks associated with coastal storms and natural hazards was expressed by individuals living in households without children than by individuals living in households with children. The difference in levels of concern was greater between both groups of respondents living at least ten miles from the coast than between both groups of respondents living within ten miles of the coast.

Whereas respondents from households with children expressed greater concern than respondents from households without children about risks from Buckeye Mill and industry, respondents from households without children expressed greater concern than respondents from households with children about risks from coastal storms and natural hazards.

Regarding both the risks associated with Buckeye Mill and industrial hazards, and the risks associated with coastal storms and natural hazards, differences in levels of concern were greater between respondents from households with children and respondents from households without children who lived away from Buckeye mill and the coast than between individuals from households with children and individuals from households without children who lived in the immediate vicinity of Buckeye Mill (within five miles) and the coast (within ten miles).

Category D: Economic Concerns *vs.* Environmental Concerns

Responses to propositions with economic implications have been compared to responses to proposals with primarily environmental implications. For each case, it has been hypothesized that individuals' levels of support for proposals with primarily environmental implications ought to differ from their levels of support for proposals with economic implications.

Industrial or human-made hazards

Responses from individuals living within five miles of Buckeye Mill to a proposal to clean up the Fenholloway River have been compared to their responses to proposals entailing specific economic costs (including shutting the mill down) to clean up the river.

H0: Levels of support expressed by people living within five miles of Buckeye Mill for a proposal to clean up the Fenholloway River are equal to their levels of support for proposals entailing specific economic costs to clean up the river.

H1: Levels of support expressed by people living within five miles of Buckeye Mill for a proposal to clean up the Fenholloway River are not equal to their levels of support for proposals entailing specific economic costs to clean up the river.

Table 4-11

	Frequency	**Mean Rank**
Negative ranks	51	26.00
Positive ranks	0	
Ties	7	
Significance Level:	0.000	

Note for Table 11: (1) Negative ranks are cases in which support for proposals with economic implications was less than support for proposals without economic implications; (2) positive ranks are cases in which support for proposals with economic implications was greater than support for proposals without economic implications; and (3) ties are cases in which support for proposals with economic implications was equal to support for proposals without economic implications.

The analysis revealed that levels of support for a proposal to clean up the Fenholloway River differed significantly (at the .10, .05, and .01 levels) from levels of support for proposals entailing specific economic costs to clean up the river. Seven of 58 respondents expressed equal levels of support for both sets of proposals; each of the other 51 respondents expressed greater support for the proposal to clean up the river than for the proposals entailing specific economic costs to clean up the river.

Natural hazards and the coastal environment

Responses from individuals living within ten miles of the coast towards a proposal to prohibit future coastal development were compared to their responses toward proposals entailing specific economic costs to protect coastal environments and coastal properties.

H0: Levels of support expressed by individuals residing within ten miles of the coast for a proposal to prohibit future coastal development are equal to their levels of support for proposals entailing specific economic costs to protect coastal environments and coastal properties.

H1: Levels of support expressed by individuals residing within ten miles of the coast for a proposal to prohibit future coastal development are not equal to their levels of support for proposals entailing specific economic costs to protect coastal environments and coastal properties.

Table 4-12

	Frequency	**Mean Rank**
Negative ranks	23	31.37
Positive ranks	32	25.58
Ties	8	
Significance Level:	0.684	

Note for Table 12: (1) Negative ranks are cases in which support for proposals with economic implications was less than support for proposals without economic implications; (2) positive ranks are cases in which support for proposals with economic implications was greater than support for proposals without economic implications; and (3) ties are cases in which support for proposals with economic implications was equal to support for proposals without economic implications. The higher the mean rank, the greater the mean difference between level of support for proposals with economic implications and level of support for proposals without economic implications.

Levels of support for a proposal to prohibit future coastal development did not differ significantly from levels of support for proposals entailing specific economic costs to protect coastal environments and coastal properties. In fact, support for proposals entailing specific economic costs to protect coastal environments and coastal properties was greater than support for the proposal to limit future coastal development. Eight of 63 respondents expressed equal levels of support for both sets of proposals, and 32 of the remaining 55 respondents expressed greater support for the proposals entailing specific economic costs to protect coastal environments and coastal properties.

Category V: Personal Exposure *vs.* Media Exposure

Responses from people who indicated that their households or properties had experienced or been impacted by particular hazards were compared to responses from people who did not indicate that their households or properties had experienced those impacts. For each case, it has been hypothesized that the perceptions and attitudes of individuals whose households or properties had experienced impacts ought to differ from the perceptions and attitudes of individuals whose households or properties had not, to their recollection, experienced such impacts.

Industrial or human-made hazards

Responses to questions or proposals related to clean up of the Fenholloway River and management of Buckeye Mill, to permits for future industry, and to the environmental impacts of industrial technology were analyzed. Responses from individuals who indicated their households or residences had ever experienced problems with water quality have been compared to responses from individuals who did not indicate that their households or residences had ever experienced problems with water quality.

H0: Perceptions of and attitudes toward risks associated with industrial or human-made hazards expressed by respondents whose households or residences have ever experienced problems with water quality do not differ from the perceptions of and attitudes toward those risks expressed by respondents whose households or residences have not experienced problems with water quality.

H1: Perceptions of and attitudes toward risks associated with industrial or human-made hazards expressed by respondents whose households or residences have ever experienced problems with water quality differ from the perceptions and attitudes toward those risks expressed by respondents whose households or residences have not experienced problems with water quality.

Table 4-13

Household water quality or health impacts	**Frequency**	**Mean Rank**
No or unsure	215	147.10
Yes	110	194.07
Significance Level	0.000	

Perceptions and attitudes of respondents whose households or residences have experienced problems with water quality differed significantly (at the .10, .05, and .01 levels) from the perceptions and attitudes of respondents whose households or residences have not experienced problems with water quality. Those whose households or residences had experienced problems with water quality were far more concerned about industrial hazard risks and supportive of proposals to clean up the Fenholloway River than were respondents who had not experienced problems with water quality.

Natural hazards and the coastal environment

Responses to questions or proposals related to development, utilization, and protection of coastal areas as well as to concern about natural hazards have been reviewed. Responses from individuals who indicated that their residences or properties had ever been damaged by storms or natural hazards were compared to responses from individuals who did not indicate that their residences or properties had ever been damaged by storms or natural hazards.

H0: Perceptions of and attitudes toward risks associated with coastal storms or natural hazards expressed by individuals whose residences or properties have been damaged by coastal storms or natural hazards do not differ from perceptions of and attitudes toward those risks expressed by individuals whose residences or properties have not been damaged by coastal storms or natural hazards.

H1: Perceptions of and attitudes toward risks associated with coastal storms or natural hazards expressed by individuals whose residences or properties have been damaged by coastal storms or natural hazards differ from perceptions of and attitudes toward those risks expressed by individuals whose residences or properties have not been damaged by coastal storms or natural hazards.

Table 4-14

Property damage from natural hazards	**Frequency**	**Mean Rank**
No or unsure	138	164.96
Yes	194	167.59
Significance Level	0.805	

Data analysis indicated that the perceptions and attitudes of those whose residences or properties had sustained damages from coastal storms or natural hazards did not differ significantly from those of subjects whose residences or properties had not sustained damages. Respondents whose residences or properties had sustained damages were slightly more concerned about risks associated with coastal storms or natural hazards than were respondents whose residences or properties had not sustained damages.

Category VI: Length of Coastal Residency

Responses to questions or proposals related to risks associated with coastal storms or natural hazards have been analyzed. Responses from coastal residents of less than five years have been compared to responses from coastal residents of five or more years. It has been hypothesized that responses ought to vary with length of coastal residency.

H0: Perceptions of and attitudes toward risks associated with coastal storms and natural hazards expressed by people whose coastal residency has been less than five years do not differ from the perceptions of and attitudes toward those risks expressed by people whose coastal residency has been at least five years.

H1: Perceptions of and attitudes toward risks associated with coastal storms and natural hazards expressed by people whose coastal residency has been less than five years differ from the perceptions of and attitudes toward those risks expressed by people whose coastal residency has been at least five years.

Table 4-15

Length of residency along the Taylor County coast	**Frequency**	**Mean Rank**
Less than five years	7	27.57
Five or more years	38	22.16
Significance Level	0.312	

Responses from people who lived along the coast less than five years did not differ significantly from those of people who resided along the coast for at least five years. Individuals who had lived along the coast for less than five years were somewhat more concerned than people who had lived along the coast for at least five years about risks associated with coastal storms and natural hazards. Of note is the fact that more than 80 percent of the respondents had lived along the coast for at least five years.

Category VII: Industrial (Human-made) Hazards *vs.* Natural Hazards

Responses to questions or proposals related to risks associated with Buckeye Mill and industrial technology in general have been compared to responses to questions or proposals related to risks associated with coastal storms and natural hazards in general. For each case, it has been hypothesized that levels of concern about risks associated with industrial hazards differ from the levels of concern about risks associated with natural hazards. Responses from three distinct groups of subjects have been analyzed.

Respondents residing in the immediate vicinity of Buckeye Mill

Responses from individuals living within five miles of Buckeye Mill to questions or proposals related to risks associated with Buckeye Mill and industrial technology have been compared to their responses to questions or proposals related to risks associated with coastal storms and natural hazards.

H0: Levels of concern expressed by respondents living within five miles of Buckeye Mill about risks associated with industrial hazards do not differ from levels of concern expressed by those respondents about risks associated with natural hazards.

H1: Levels of concern expressed by respondents living within five miles of Buckeye Mill about risks associated with industrial hazards differ from levels of concern expressed by those respondents about risks associated with natural hazards.

Table 4-16

	Frequency	**Mean Rank**
Negative ranks	6	20.17
Positive ranks	33	19.97
Ties	8	
Significance Level	0.000	

Note for Table 16: (1) Negative ranks are cases in which concerns/fears about natural hazards exceed concerns/fears about industrial hazards; (2) positive ranks are cases in which concerns/fears about industrial hazards exceed concerns/fears about natural hazards; and (3) ties are cases in which concerns/fears about industrial hazards are equal to concerns/fears about natural hazards. The higher the mean rank, the greater the mean difference in level of concern/fear about industrial hazards and level of concern/fear about natural hazards.

Respondents' levels of concern about risks associated with industrial hazards differed significantly (at the .10, .05, and .01 levels) from their levels of concern about risks associated with natural hazards. Levels of concern about risks from Buckeye Mill's operation and industrial hazards were significantly greater than levels of concern about risks from coastal storms and natural hazards.

Respondents residing in the immediate vicinity of the coast

Responses from individuals living within ten miles of the coast to questions or proposals related to risks from Buckeye Mill and industrial hazards have been compared to their responses to questions or proposals related to risks from coastal storms and natural hazards.

H0: Levels of concern expressed by people residing within ten miles of the coast about risks associated with industrial hazards do not differ from their levels of concern about risks associated with natural hazards.

H1: Levels of concern expressed by people residing within ten miles of the coast about risks associated with industrial hazards differ from their levels of concern about risks associated with natural hazards.

Table 4-17

	Frequency	**Mean Rank**
Negative ranks	12	13.04
Positive ranks	46	33.79
Ties	4	
Significance Level	0.000	

Note for Table 17: (1) Negative ranks are cases in which concerns/fears about natural hazards exceed concerns/fears about industrial hazards; (2) positive ranks are cases in which concerns/fears about industrial hazards exceed concerns/fears about natural hazards; and (3) ties are cases in which concerns/fears about industrial hazards are equal to concerns/fears about natural hazards. The higher the mean rank, the greater the mean difference in level of concern/fear about industrial hazards and level of concern/fear about natural hazards.

Levels of concern about risks associated with industrial hazards differed significantly (at the .10, .05, and .01 levels) from levels of concern about risks associated with natural hazards. Despite residing less distance from the coast than from Buckeye Mill, these respondents were more concerned about risks from industrial hazards than risks from natural hazards. Of note is the fact that differences in levels of concern about risks from industrial hazards and levels of concern about risks from natural hazards were more significant for respondents living within ten miles of the coast than for respondents living within five miles of Buckeye Mill.

Respondents residing neither within neither the immediate vicinity of Buckeye Mill nor within the immediate vicinity of the coast

Responses from people living at least five miles from Buckeye Mill and at least ten miles from the coast to questions or proposals related to risks associated with Buckeye Mill and industrial hazards in general and to questions or propositions related to risks associated with coastal storms and natural hazards in general have been compared.

H0: Levels of concern expressed by respondents living further than five miles from Buckeye Mill and further than ten miles from the coast about risks associated with industrial hazards do not differ from their levels of concern about risks associated with natural hazards.

H1: Levels of concern expressed by respondents living further than five miles from Buckeye Mill and further than ten miles from the coast about risks associated with industrial hazards differ from their levels of concern about risks associated with natural hazards.

Table 4-18

	Frequency	**Mean Rank**
Negative ranks	36	58.83
Positive ranks	124	86.79
Ties	28	
Significance Level	0.000	

Note: (1) Negative ranks are cases in which concerns/fears about natural hazards exceed concern/fears about industrial hazards; (2) positive ranks are cases in which concerns/fears about industrial hazards exceed concerns/fears about natural hazards; and (3) ties are cases in which concerns/fears about industrial hazards are equal to concerns/fears about natural hazards. The higher the mean rank, the greater the mean difference in level of concern/fear about industrial hazards and level of concern/fear about natural hazards.

Degrees of concern about risks associated with industrial hazards differed significantly (at the .10, .05, and .01 levels) from degrees of concern about risks associated with natural hazards. As with the previous two cases, respondents expressed far greater concern about risks from industrial hazards than about risks from natural hazards.

Of the three populations of respondents, those residing within ten miles of the coast expressed the highest levels of concern about risks from industrial hazards and those residing neither within five miles of Buckeye Mill nor within ten miles of the coast expressed the highest levels of concern about risks from natural hazards. Respondents living within five miles of Buckeye Mill expressed the lowest levels of concern about risks associated with both classes (industrial and natural) of hazards.

Additional Test

An additional test was conducted to analyze relationships between several personal or background characteristics and level of concern about environmental hazards.

Ordered logit regression analysis was performed on and between each of the following dependent variables: age, sex, income level, as well as level of education. The results yielded no statistically significant relationships at either the .01 or .05 levels. At the .10 level of significance, a relationship existed between one of the four variables, level of education, and level of concern about environmental hazards. Individuals educated beyond the secondary level expressed somewhat more concern than was expressed by lesser educated respondents.

Other Noteworthy Findings

The entire population of respondents was also scrutinized to ascertain degrees of concern pertaining to environmental hazards. Not every member of the population responded to each of the survey questions or proposals. The minimum value for each response variable to be noted was 1.0, indicating: (a) minimum levels of concern about risks associated with environmental hazards, (b) minimum levels of support for all but one question or proposal related to Buckeye Mill or industrial hazards or coastal protection and natural hazards, or (c) maximum levels of support for the proposed pipeline from Buckeye Mill to the Gulf coast, while the maximum value for each response variable was 5.0, indicating the opposite.

Levels of concern about environmental hazards

The mean level of concern about industrial or technological hazards in general was 3.59 and exceeded the mean level of concern about natural hazards in general, 3.07.

When asked to compare levels of concern about industrial hazards and about natural hazards, more than three times as many respondents expressed greater levels of concern about industrial hazards than about natural hazards.

Despite the levels of concern about industrial hazards and natural hazards, belief that environmental hazards are manageable was relatively strong. While 215 respondents believed environmental hazards are manageable, only 27 respondents held that the hazards are unmanageable.

Support for issues or proposals related to Buckeye Mill and industrial hazards

Levels of support for efforts to clean up the Fenholloway River, without specific reference to any accompanying costs, exceeded levels of support for any of the other questions or proposals related to industrial or natural hazards. The mean level of support for efforts to clean up the river was 4.32 (out of a possible 5.0 and thus reflecting relatively strong support).

When a need for increased taxes was included to fund efforts to clean up the river, the mean level of support decreased to 3.08.; when a need to shut down Buckeye Mill was included with efforts to clean up the river, the mean level of support decreased further to 2.59. While only nine of 349 (2.6 percent) respondents strongly opposed efforts to clean up the Fenholloway River, 120 of 343 (35 percent) respondents strongly opposed efforts to clean up the river if the mill were to be shut down.

A proposal requiring that new or potential businesses or industries must demonstrate that their operations would not cause environmental damage before those operations are authorized received high support. The mean level of support for this proposal was 4.22. Not surprisingly, opposition to the proposed pipeline from Buckeye Mill to the coast was strong among coastal residents (the only respondents asked to indicate their levels of support for the proposed pipeline). The mean level of opposition was 4.41.

Support for issues or proposals related to coastal environments and natural hazards

Support for a proposal to strengthen building codes for coastal structures was stronger than support for each of three other alternatives or proposals. The mean level of support for this proposal was 4.06. Greater than one-half of the respondents (190 of 345) strongly approved of the proposal. The lowest level of support for any of these four alternatives or proposals was for a proposal that coastal property owners no longer be eligible for governmental financial assistance to pay for damages sustained from storms. The mean level of support was 2.74. The most frequent of five responses given was strong opposition to the proposal (124 of 345 respondents, 36 percent). The mean level of support for a proposal to limit coastal development was 2.90, and the mean level of support for State purchase of undeveloped coastal and environmentally sensitive lands with taxpayers' money was 3.28.

Additional findings

When asked about change in Florida's quality of life over the past 50 years, the most frequent response was that the quality of life had somewhat deteriorated (116 of 333 respondents, 35 percent). While 45 respondents indicated that they thought the quality of life had greatly improved, 61 respondents indicated that they thought the quality of life had highly deteriorated over that period.

A significant majority of respondents (285 of 350, 81 percent) were not presently employed in the recovery, production, or processing of environmental resources, each of which could be classified as environmentally exploitative activities. Greater than 60 percent (215 of 341, 68 percent) of those who responded were 50 years of age or younger; nearly 60 percent (192 of 334) of those who responded were female. The annual income range of a majority of respondents (168 of 328, 51 percent) was $20,000 to $50,000, implying that most survey subjects were of middle socioeconomic class standing. A majority of respondents (200 of 339, 59 percent) indicated they resided in households without children. Better than 70 percent (238 of 334) of people who responded indicated they had been educated beyond the secondary (high school) level, and therefore it could be assumed that a majority of subjects were capable of comprehending issues addressed in this study.

The survey yielded several significant findings, many of which were not predicted. Several other less significant findings were surprising as well. Additional analysis and interpretation of these findings ought to provide considerable information about the perceptions and attitudes of residents of the survey region. A discussion of the results follows.

CHAPTER 5
DISCUSSION OF FINDINGS AND CONCLUSION

This survey yielded several findings which provide valuable information to efforts to determine why people react to environmental hazards as they do. Several tests produced highly significant insights related to perceptions and attitudes about hazards. Type of residential environment (rural vs. urban), distance between one's residence and hazards or sites highly exposed to hazards, level of prior personal experience with or impact from hazards, economic factors related to hazard management, as well as distinctions between industrial hazards and natural hazards were each found to significantly influence respondents' perceptions and attitudes about environmental hazards.

Levels of concern about both industrial hazards and natural hazards varied significantly between residents of urban areas and residents of rural areas, as was implied by and thus should have been expected according to Couch and Kroll-Smith as well as Greenberg, et al. Differences in levels of concern between the two groups were greater for industrial hazards than natural hazards. Urban areas are more developed than rural areas and tend to be impacted more by industrial activities or byproducts of utilization of industrial goods (such as exhaust from motor vehicles). Perhaps daily exposure to higher levels of industrial byproducts contributes to a higher awareness of the consequences of industrial activity among residents of urban areas. Tallahassee is far more densely populated than any of the other survey sites. Traffic congestion and other daily inconveniences typically associated with crowded conditions are more common in Tallahassee than the other sites and may have influenced the responses of its residents. Further, Tallahassee is the capital of Florida and is home to two of the state's public universities. The economy of Tallahassee (and urban areas in general) is more diversified than the economies of the other survey sites. For these reasons, respondents from Tallahassee may be more inclined than those from rural survey sites to believe that a community's economic welfare does not have to be tied to particular industries or depend primarily on heavy industry. As mentioned by Couch and Kroll-Smith and by Greenberg, et al., rural communities are generally more financially constrained than urban communities and less able to afford to actively prevent or effectively respond to local hazardous enterprises. Also of note is the fact that unlike Perry or the coastal communities of Taylor County, none of the rural sites from which data was used in hypotheses tests comparing responses from urbanites and ruralites are directly threatened by runoff from Buckeye Mill. If these sites were directly threatened, perhaps levels of concern expressed by ruralites would have been higher.

Accounting for differences in levels of concern about natural hazards expressed by residents of Tallahassee and residents of rural survey sites seems somewhat more problematic than accounting for differences in levels of concern about industrial hazards. One possible explanation may be linked to stormwater runoff and flooding. Urban area land surfaces are proportionately more paved or covered than are rural land surfaces.

Rates of absorption of rain or stormwater are lower and rates of surface runoff are higher in urban areas. Collectively this implies greater flood potential for low lying urban areas than low lying rural areas. Flooding is a major risk associated with natural hazards, especially hazards to which this survey region is highly susceptible. Another possible contributing factor accounting for the greater concern among residents of Tallahassee may be greater awareness of risks associated with natural hazards the area is not particularly susceptible to. This explanation, however, assumes that residents of urban areas have greater access than residents of rural areas to news and information about events outside of the region. This would seem to counter claims that gaps no longer exist between rural cultures' awareness and urban cultures' awareness of worldly events. A third possible explanation accounting for greater concern about natural hazards among residents of Tallahassee may be related to levels of concern about industrial hazards. Perhaps levels of concern expressed by respondents about one type of hazard influenced levels of concern expressed about the other type of hazards. Most of the survey questions or proposals related to natural hazards on the survey questionnaire were listed after the questions or proposals related to industrial hazards.

When responses from residents of communities in Taylor County were drawn into the analysis, differences between levels of concern among urbanites and ruralites were reduced. Although respondents from Tallahassee still expressed a greater level of concern than was expressed by residents of rural areas, the difference was not statistically significant. Of note is the fact that this comparison was based only on concern about environmental hazards in general and did not differentiate between industrial hazards and natural hazards. Also, as noted in Chapter 4, coastal residents (all of whom reside in Taylor County) were the least concerned of any group of respondents about risks from natural hazards, but were the most concerned of any group about risks from industrial hazards. Likewise, respondents living within five miles of Buckeye Mill (and thus within Taylor County) were the least concerned of any group about risks from industrial hazards. If responses related to concerns about risks from industrial hazards had been tested separately from responses related to concerns about risks from natural hazards or if responses from only residents of interior (non-coastal) sections of Taylor County had been included with those from residents of rural areas outside of Taylor County, then perhaps urbanites' and ruralites' perceptions of risks associated with one or both types of hazard would have remained significantly different.

Differences in levels of concern about risks from industrial hazards and about risks from natural hazards varied significantly between parties residing different distances from areas heavily exposed to impacts from Buckeye Mill and from coastal storms. In Chapter 1, it was conjectured that concern about risks from a hazard ought to decrease as distance between one's residence and that hazard increased. The results of this study, however, suggest the reverse; respondents residing the furthest distances from Buckeye Mill and from the coast respectively expressed the highest levels of concern about risks from industrial hazards and risks from natural hazards.

In Chapter 1, it was also reasoned, however, that financial factors ought to influence individuals' attitudes about activities that have economic implications and pose risks. Perhaps the responses of individuals residing near Buckeye Mill to questions or proposals related to the mill's operation were influenced more by financial factors (for which the mill's operation is beneficial to the local community) than by environmental factors (for which the mill's operation is costly to the local community). Couch and Kroll-Smith as well as Fowlkes and Miller mentioned that responses from many residents of communities already impacted by or economically dependent upon hazardous industries were influenced by concerns about disruption of already established community networks and means of existence.

In Chapter 2, mention was made of the studies by Baker and Cross which concluded that concern about coastal storm hazards tended to decrease as length of coastal residency increased. This implies that people may psychologically adapt to living in hazard prone areas by choosing to downplay or ignore risks from the hazards rather than by dwelling on or becoming highly concerned about the risks. If this applies to residents of coastal areas, then it may apply as well to residents of areas highly exposed to risks from other types of hazards. Couch and Kroll-Smith mentioned that awareness of the actual presence of hazardous impacts greatly complicates risk appraisal, and Mitchell noted a tendency for risks to be underestimated in order to alleviate fears or concerns about living under continual threat. These assessments further imply that individuals who are highly concerned about risks from hazards would psychologically find it difficult to cope with residing in the vicinity of hazards and thus would opt to live elsewhere. By this line of reasoning, it would be expected (as was found in this survey) that concern about risks from hazards would decrease as distance between one's residence and areas exposed to risks from hazards decreased.

Surprisingly, it was found that levels of concern about risks from industrial hazards and about risks from natural hazards expressed by individuals residing in households with children did not differ significantly from levels of concern expressed by respondents living in households without children. In Chapter 2, it was noted that residents of households with children in Love Canal (a site heavily impacted by chemical, industrial, hazards) displayed far greater concern about potential impacts than was shown by residents of childless households. Thus far, there have been very few, if any, adverse health impacts that can be definitively and directly linked to effluent from Buckeye Mill. It was not until definite links were made in Love Canal that concerns about risks from a specific hazard began to mount. Perhaps verification of definite links is necessary before concerns about future adverse health effects become significant.

As mentioned in Chapter 4, individuals from households with children were slightly more concerned about risks from industrial hazards than were respondents from households without children. However, surprisingly differences in levels of concern were greater among people living at least five miles from Buckeye Mill than among those residing within five miles of the mill. This may possibly be tied to the previously noted implication that people living in the immediate vicinity of hazards tend to psychologically downplay rather than dwell upon risks associated with those hazards as well as to financial factors related to Buckeye Mill's operation. Raising children requires financial resources, and the mill is likely a primary source of income for numerous families residing in the immediate vicinity of the mill. Economic benefits from the mill may outweigh perceived costs or risks associated with the mill; costs associated with loss of these economic benefits may exceed costs associated with hazardous risks.

Although levels of concern were not significantly different, it was somewhat surprising that respondents from childless households were more concerned than those from households with children about risks associated with natural hazards. Some of this may be due to age differences; elderly people tend to be less mobile than others and less able to evacuate or take other protective measures in response to risks from storms. This may account for greater levels of concern than found among younger and more mobile adults living with children. In either case, this finding was less surprising than if it had been found that respondents from childless households expressed more concern than those from households with children about risks from industrial hazards. Impacts from Buckeye Mill and other industrial hazards can accumulate over time; long-term exposure will generally pose greater risks than short-term exposure. This implies that individuals who grow up around Buckeye Mill will face greater risks than residents of the area who either were not raised near the mill or who were raised in that location before the mill began operation. Risks from exposure to coastal storm hazards generally do not accumulate over time; a coastal resident who grew up along the coast faces no greater present risk than a resident who moved to the coast during adulthood. One should not expect as much concern about risks (especially long-term ones) to children from coastal storms than about risks to children from Buckeye Mill.

Respondents living within five miles of Buckeye Mill expressed far less support for proposals with economic implications for clean up of the Fenholloway River than for related proposals without economic implications. Support was lowest for a proposal entailing shut down of Buckeye Mill in order to improve the Fenholloway River water quality. Not surprisingly, support was strong for mere clean up of the river; much of this may be related to economic as well as environmental or health factors. Whereas the benefits to be gained from each of the proposals related to clean up of the river are equivalent, the costs expected to be directly experienced by residents of the survey region from each of these proposals would vary. Cleaning up the Fenholloway River through increased taxation allows costs to be equally spread across the entire state of Florida; cleaning up the river by shutting down Buckeye Mill entails extreme local costs and little or no direct costs for areas beyond the survey region. The "expected utility" for the local area from mere clean up of the river exceeds the "expected utility" from clean up of the river through increased taxes, which, in turn, exceeds the area's "expected utility" from clean up of the Fenholloway by closure of the mill.

Nearly, if not, all of these respondents are aware of the controversy surrounding Buckeye Mill and pollution of the Fenholloway River as well as of the opinions held by some that the mill ought to be shut down. Perhaps many people believe that if the river were to be cleaned up, then beliefs that the mill should cease or cut back its operation would disappear. In other words, they believe that clean up of the river would preclude the possibility of any economic set backs. Although support for a proposal to clean up the Fenholloway River through increased taxation was lower than support for the proposal to merely clean up the river, support for clean up through increased taxation was greater than support for clean up through closure of Buckeye Mill. It is likely that fears or perceived risks associated with potential loss of local employment and revenue if the mill were to be shut down exceeded fears associated with increased rates of taxation. Closure of the mill primarily affects the local economy and interests; increased taxes would be felt across a larger area and be of far less impact locally. It is quite apparent that concerns about financial losses or risks associated with cut back of Buckeye Mill's operation or with other costs specified for improvement of the Fenholloway River's water quality reduced levels of support for clean up of the river. This implies that although concerns about impacts from an industrial hazard may be significant, those concerns can be greatly modified if that industrial hazard is a source of economic security or other benefit. This is especially true if there are no apparent immediate substitutes for that source of benefit. It is highly unlikely that Taylor County would be able to rapidly recover lost jobs and local revenues if Buckeye Mill, the county's largest employer, were to cease or drastically cut back its operation. Desires for financial benefits and concerns about financial losses were found by Greenberg et al. and by Fowlkes and Miller to have been responsible for communities opting to advocate and allow hazardous facilities to operate locally. Starr noted it is common for workers to voluntarily accept risks in exchange for increased financial compensation even though additional levels of risk generally exceed added compensation. Consistent with this, residents of Taylor County may be more concerned about job security than job safety.

When addressing risks and impacts from coastal storms and similar natural hazards, support expressed by respondents living in the vicinity of the coastline for proposals with economic implications did not differ significantly from their support for proposals lacking economic implications. In fact, proposals entailing economic costs for coastal property owners received slightly higher approval than a proposal to prohibit future coastal development. Support for a proposal to strengthen building codes for future repair or construction of coastal structures was higher than support for any other proposal related to natural hazards and coastal protection. Although strengthened building codes equate with higher repair or replacement costs, they may also equate with lower costs thereafter due to decreased potentials for damage to structures. It could then be argued that economic factors influenced responses to this proposal. A proposal that coastal property owners no longer be eligible for governmental support and that they assume full financial responsibility for damages from storms or other natural hazards was the only proposal entailing direct economic costs for coastal property owners that received less support than the proposal to limit future development of coastal areas. It could be argued that a proposal to limit future coastal development poses potential economic opportunity costs for coastal residents by limiting economic growth. However, unlike the other proposals, this does not entail any costs for maintaining or securing respondents' present coastal homes and property in the event of a natural disaster.

Economic implications of proposals related to Buckeye Mill very likely outweighed economic implications of proposals related to coastal storms. Employment is typically a primary concern of people; whereas none of the proposals related to reduction of risks from natural hazards entailed potential job losses, one of the proposals related to reduction of risks from industrial hazards entailed loss of a major source of employment. Not surprisingly, opposition towards that proposal by respondents across the survey region was stronger than their opposition towards any other proposal related to reduction of risks from either type of hazard. Hall found that responses to hazards were influenced very differently by personal concerns about monetary or pecuniary wealth and concerns about environmental welfare.

Results of the survey indicated that prior experience with household water quality problems influenced responses to proposals related to risks from industrial hazards more than prior experience with residential property damage from storms influenced responses to proposals related to risks from natural hazards. Beatley and Brower found that perceptions about the severity of impacts from Hurricane Diana were greater among residents of non-directly impacted areas than residents directly impacted by the storm. Although a majority of respondents in Taylor County and the surrounding area had at some time owned or lived on property that had been damaged by storms or other natural hazards, only approximately one third of the respondents had ever experienced problems with household water quality. Those who had experienced problems with household water quality expressed greater concern about risks from industrial hazards than was expressed by others about those risks or was expressed about risks from natural hazards by respondents either who had or had not experienced property damage from natural events. Perhaps the perceived seriousness of both types of impact differed significantly. On one hand, any noticeable problem with household water quality might constitute a serious health concern; on the other hand, minor property damage from a storm or other natural hazard generally does not constitute a serious concern. It may be the case that minor property damages were experienced by many or most of the respondents who indicated that their properties had been impacted by natural hazards. If actual extents of damage had been indicated and only responses from subjects who had experienced serious damages were tested, then the results may have been different. It should further be pointed out, however, that property damage is normally visible and easy to link to a particular cause; problems stemming from and responsible for adverse household drinking water quality are often invisible and difficult to link to particular causes. As Couch and Kroll-Smith and as Fowlkes and Miller found, uncertainties can greatly complicate and thus influence responses to risks from hazards and can be a basis of community polarization.

Whereas storms occasionally impact the study area, the controversy surrounding Buckeye Mill has been a continuing issue of concern in Taylor County. When a major storm or natural hazard does impact the area, most attention (including from the media) is directed at that event; but once the storm or hazard has passed or greatly subsided, levels of attention paid to it rapidly diminish. Although levels of attention paid to industrial disasters tend to decrease after the events, controversies associated with Buckeye Mill have often arisen independent of any specific disastrous incident or adverse impact. The local media has regularly devoted attention to particular issues and decisions related to Buckeye Mill and having major implications for the economic future of the area. Public controversy has arisen. Fowlkes and Miller as well as Pagan specifically noted that concerns about public controversy or disruption of established social networks greatly influenced reactions toward hazards. In light of this, one might expect relatively high levels of concern about risks from industrial hazards to be expressed by those who had experienced household water quality problems and by those who had not experienced such adversities and that differences in levels of concern expressed by both groups would be less than differences in levels of concern about risks from natural hazards expressed by those who had experienced property damage from storms and by those who had not experienced such damages. Results of this survey, however, indicated otherwise.

Length of coastal residency did not significantly affect levels of concern about risks from coastal storms. It should be noted that only seven of the 45 subjects included in this test had resided along the coast for less than five years. Prior studies had generated mixed results. Studies conducted by Baker and by Cross found that concern about risks from coastal storms tended to decrease with increased duration of coastal residency. Beatley and Brower's study yielded positive relations between length of coastal residency and intent to evacuate the coast in the event of future threats from storms. Although results of the current study indicated a slightly higher level of concern among shorter-term coastal residents than among longer-term coastal residents, the difference in levels of concern was insignificant. Respondents were not asked to indicate numbers of- or intensities of storms or other natural hazards experienced in their pasts. Perhaps if length of coastal residency and prior experience with coastal storms or other natural hazards had been considered jointly, then a significant difference might have existed. Actual experience with natural hazards may influence perceptions of associated risk more than length of exposure to risks from those hazards. It might also have proved worthwhile to have gathered information about respondents' childhoods and to have compared perceptions and attitudes of those who had been raised in coastal environments and those who had not been raised along a coast.

As noted or implied by Couch and Kroll-Smith, Cutter, Mitchell, and Pagan, concerns about and responses toward industrial hazards vary from concerns about and responses toward natural hazards. Across the entire Big Bend survey region, respondents were significantly more concerned about risks associated with Buckeye Mill and industrial hazards than about risks associated with coastal storms and natural hazards. At the time of the survey, the regions was not impacted by any major storms or other natural events.* Although the region did not experience any major industrial accidents at the time, public hearings regarding the proposed pipeline from Buckeye Mill towards the Gulf of Mexico and the ongoing efforts to clean up the Fenholloway River continued to be newsworthy events.+ Coastal residents expressed the highest levels of concern over risks associated with industrial hazards. Although they reside further than ten miles from Buckeye Mill, many felt at risk because of wastewater flowing from the mill towards the Gulf of Mexico and perhaps more at risk because of the proposed pipeline that would transport wastewater directly from the mill to an estuary flowing into the Gulf. Coastal residents' opposition towards the proposed pipeline was stronger than any other particular group's support or opposition of any proposal. As was mentioned by Bailey and Faupel,

---

*During the summer of 1998, several areas in Florida, including portions of Taylor County, suffered major wildfires due to regional drought. Later that summer, a natural gas pipeline was struck by lightning in northern Perry causing a major explosion and a 500 foot high flame of fire.

+Controversy has continued regarding the proposed pipeline. Plans for the pipeline were put on hold in the spring of 1998. Later, during the summer of 1998, the Fenholloway River was ranked as the third most polluted water body in Florida. Several major decisions are pending concerning the proposed pipeline and alternative means of improving the Fenholloway River's water quality. This controversy is far from being resolved to the satisfaction of all concerned parties.

Hall, Morell and Singer, as well as by Couch and Kroll-Smith, community reactions to proposed sitings of industrial facilities were strong and generally consistent. Citizen groups' unified efforts were able to prevent siting of hazardous facilities in their communities. Residents of the Taylor County coastline are uniformly opposed to the proposed pipeline.

Although coastal residents of Taylor County live in the immediate vicinity of threats from coastal storms, they voluntarily chose to live within that hazardous zone. They did not, on the other hand, voluntarily opt to live in an area which is in their minds potentially (if not actually) at risk from emissions out of an industrial hazard. This implies that Starr's and others' findings about differences between reactions to voluntary and to involuntary exposure to risk merit serious consideration by parties involved with risk management.

It could be argued on the other hand that people who have moved into residences within five miles of Buckeye Mill have voluntarily opted to live in the vicinity of an industrial hazard. Although respondents residing in this district were not asked to indicate whether they occupied their present homes before the construction of Buckeye Mill (in the 1950's), it is likely that many moved into their residences since the mill began operation and thus voluntarily chose to live in the vicinity of the mill. This together with what was noted as a tendency for residents of hazard prone areas to downplay rather than dwell on risks from nearby hazards could explain why these respondents expressed lower levels of concern about risks from industrial hazards than was expressed by any of the other groups. Whether or not these respondents voluntarily chose to reside in an area vulnerable to impacts from natural hazards is debatable. Perry is well within twenty miles of the coast; it could be argued that although the area does not face the same degree of risk as the immediate coastline, it nonetheless is within a zone of potential impact. It might also be argued, on the other hand, that proximity to the coastline or any area heavily exposed to natural hazards had little if anything to do with these people's decisions to reside in Perry. This would imply that these respondents knowingly chose to live in an area susceptible to risks from an industrial hazard but did not knowingly choose to reside in an area exposed to risks from coastal storms. The aforementioned financial benefits from the operation of Buckeye Mill have likely further eroded fears of risk from the mill. In spite of this line of reasoning, this group (like every other one) of respondents indicated greater concern about risks from industrial hazards than risks from natural hazards. This would seem to add weight to claims that concerns or fears of risks from industrial hazards generally exceed concerns or fears of risks from natural hazards.

Couch and Kroll-Smith asserted that differences between community response to natural hazards and to industrial hazards may in part be due to greater awareness about the effectiveness of different stages of management of natural hazards than of different stages of industrial hazard management. Management of the controversy surrounding Buckeye Mill has been somewhat inconsistent and haphazard. Many decisions have been inconclusive, delayed, or reversed. This indecisiveness has very likely added to the controversy.

As noted in Chapter 4, respondents who lived neither in the vicinity of Buckeye Mill nor along the coastline were the most concerned of any group about risks from natural hazards. This group included all respondents who lived further than 20 miles from the coast and thus faced the lowest levels of risk from coastal storms. This group included, as well, residents of Tallahassee, the only urban classified area in the survey. Perhaps a tendency for residents of highly exposed areas to downplay risks, the aforementioned problems with urban stormwater runoff, and the possibility that residents of Tallahassee are more aware than other survey subjects about natural hazards that rarely or never pose immediate threats to the region at least partially explain why these respondents were the most concerned about risks from natural hazards. But also, as mentioned, they were even more concerned about risks from industrial hazards.

People's responses may have been affected to some extent by the timing of this survey. Although the survey region is vulnerable to impacts from coastal storms, damage from storms and other natural hazards had been relatively insignificant between the March 1993 "Storm of the Century" and the time during which the surveys were administered. Buckeye Mill, on the other hand, had been a relatively constant source of controversy and debate among residents of Perry and the surrounding area throughout at least the period of time between the aforementioned 1994 study and the administration of this survey in the summer and fall of 1997. It is likely that responses of area residents would have differed if the region's recent experiences with and impacts from natural and industrial hazards had been different.

Several noteworthy conclusions can be drawn from this study. It is clear that respondents throughout the region of analysis expressed far greater concern about risks associated with Buckeye Mill and industrial hazards than about risks from coastal storms and natural hazards. Although respondents expressed high levels of concern about risks from Buckeye Mill, their attitudes towards the mill were affected by far more than risks posed by the mill. Economic, psychological, and other social factors, including high levels of controversy arising from issues and decisions related to the mill, have influenced perceptions and attitudes about Buckeye Mill.

Although the Taylor County area is exposed to risks from Buckeye Mill and coastal storms, considerably more attention has been paid over the past few years to controversies surrounding the mill than to coastal storms or other natural hazards. Very little county-wide attention has been devoted to storms since the aftermath of the March 1993 "storm of the century." Although some coastal residents have objected to laws requiring coastal structures to be elevated, very little dissension between residents of Taylor County has arisen. Generally, reactions to threats from coastal storms (including Hurricane Josephine) have promoted community cohesion.

This, however, has not been the case with Buckeye Mill. Even in the absence of a major or unusual mishap, considerable attention has been devoted to the mill. The interests of people beyond those at risk from the mill's operation stand to be potentially affected by decisions regarding the mill's future. Several people's livelihoods are at stake. Responses to risk management decisions have been heavily based on the implications of those decisions concerning affected parties' livelihoods and economic welfare. It is highly unlikely that any major decisions reached will be to everyone's satisfaction. Despite the high level of economic benefit brought about by the mill's operation, concerns over risks emanating from that operation are real. If an alternative means of providing the financial benefits without the associated risks became available, there is little reason to doubt that it would readily be accepted and promoted by the residents of Taylor and surrounding counties. In other words, if the "expected utility" from operation of the mill could be equaled or exceeded by the "expected utility" from an alternative course of action which entailed cutting back or terminating Buckeye Mill's operation, then there is little reason to believe that local residents would not support the alternative course of action.

It was surprising in this study that concerns about risks from environmental hazards increased as distance between one's residence and a hazard or hazard prone area increased. This may reflect psychological adjustment or acceptance of risks as a means of coping with or minimizing anxieties, frustrations, or other adverse feelings as well as a tendency for people to reside in areas they find livable or tolerable. A study which compared the influences of these factors on the perceptions and attitudes of residents of hazard prone areas ought to yield valuable information.

As expected, results of this study indicated that residents of urban areas were more concerned than residents of rural areas about risks from Buckeye Mill and industrial hazards. It was also, as expected, confirmed that respondents whose households had experienced adverse impacts from industrial hazards felt more threatened than others by risks from industrial hazards. As hypothesized earlier, perceptions and attitudes about industrial hazards were heavily influenced by economic factors. Also as predicted, reaction to industrial hazards varied significantly from reaction to natural hazards. Contrary to expectations, levels of concern about risks from hazards did not decrease as distance between one's residence and hazardous sites increased. Also of surprise was a finding that respondents from households with children were not significantly more concerned about risks from hazards than were respondents from childless households.

Results of this analysis appear to confirm Chauncey Starr's belief that reactions to hazards vary according to whether or not those hazards are voluntarily encountered by at-risk parties, as well as Leah Pagan's findings that reactions to hazards can be greatly influenced by the social environment or fabric of a community. As stated or implied by Bailey and Faupel, Couch and Kroll-Smith, Fowlkes and Miller, and O'Riordan and Rayner, community conflict and/or distrust of public officials greatly influences hazard response and management. This study also supports Hewitt's contention that socio-culturally relevant factors must be taken into account if response to hazards is to be understood and effectively managed. Couch and Kroll-Smith's conclusion that communities tend to be more unified in reaction to proposed sitings of hazardous facilities than in reaction to local hazards already posing risks was confirmed as well by this study.

Tests of people's reactions to industrial hazards were generally more significant than tests of their reactions to natural hazards. Survey proposals related to industrial hazards were more specific than proposals related to natural hazards. It might have proved worthwhile to ask respondents about specific risks (such as flooding or damage from winds) associated with natural hazards or about their intentions to take specific actions (such as evacuation or precautionary property protection) in the event of future threats from coastal storms or other natural hazards.

Future studies of communities' reactions to environmental hazards should consider issues beyond the hazards and associated risks in and of themselves. As noted or suggested by Couch and Kroll-Smith, Fowlkes and Miller, Hewitt, Kates, and Starr, human response to environmental hazards is complex and multi-faceted. Risk assessments need to pay attention to socially-driven factors which extend beyond probabilities of mishap, injury, or fatality. Effective risk management entails understanding why people choose to engage in activities which expose them to risks from environmental hazards.

Hazard perception, management, and risk assessment are complex and multi-dimensional issues. Intangible and often difficult to specify or measure factors influence people's reactions towards hazards and decisions made by others about those hazards. Reactions to hazards and interpretation of those reactions are highly subjective. Ignoring the complexity of people's reactions to hazards may simplify risk assessment and policy formulation; but if an objective of risk management is effective management of at-risk parties' reactions towards hazards and policies addressing those hazards, then those complexities need to be taken into account. Management of environmental hazards entails high degrees of scientific (physical as well as social) analysis; however, management of those hazards is anything but a purely objective or exact science.

APPENDIX
SURVEY QUESTIONNAIRE

ENVIRONMENTAL HAZARD PERCEPTION

A Survey of Residents of Taylor County and Surrounding Counties

Dear Resident of Taylor County or of a Surrounding Big Bend County:

Taylor County and the Big Bend area have been affected by impacts from natural events and impacts from human activity. Major coastal storms (natural events), including Hurricane Josephine this past October and "The Storm of the Century" in March 1993, have impacted the area. Pollution from industry (human activity), including discharge or runoff from Buckeye Mill into the Fenholloway River, has impacted the area. Although some people believe the impacts have been severe, living along the coast as well as the operation of Buckeye Mill have been sources of pleasurable experiences as well as economic benefit (including employment of residents of the area).

I am conducting a study of the reactions of residents of Taylor County and the surrounding area to these events or activities and their impacts. Short-answer questionnaires addressing these activities and impacts are being distributed to residents of the area. It would be greatly appreciated if, at your convenience, you would complete the questionnaire, enclose it in the stamped and addressed envelope, and return it to me. Completion of the questionnaire should require no more than 10 to 15 minutes of your time. I am a student at the University of Florida in Gainesville and an instructor at Florida State University in Tallahassee.

Thank you for your time.

Questions Asked of Respondents

I. Personal or Household Demographics

1. Present Residence
    - A. Rural
    - B. Urban

2. Primary Childhood Residence
    - A. Rural
    - B. Urban

3. Present Employment
    - A. The recovery, production, or processing of environmental resources (agriculture, construction, lumbering, mining, manufacturing, etc.)
    - B. Other

4. Primary Household Employment during Childhood
    - A. The recovery, production, or processing of environmental resources (agriculture, construction, lumbering, mining, manufacturing, etc.)
    - B. Other

5. Age
    - A. 50 or younger
    - B. Older than 50

6. Sex
    - A. Female
    - B. Male

7. Annual Household Income
    - A. Less than $20,000
    - B. $20,000-$50,000
    - C. Greater than $50,000

8. Household Structure
    - A. Number of Members: ______
    - B. Of these, how many are children (under 18 years of age)? ______

9. Education
    - A. Beyond Secondary (Some College)
    - B. Secondary (High School) or Less

10. The distance from my residence to Buckeye Mill is
    A. Less Than 5 Miles
    B. 5-10 Miles
    C. Greater Than 10 Miles

11. The distance from my residence to the coast is
    A. Less Than 10 Miles
    B. 10-20 Miles
    C. Greater Than 20 Miles

12.* For how many years have you lived along the Taylor County coastline? ____

II. General Concern About and/or Fear of Hazards

13. To what extent are you concerned about and/or fearful of the forces of nature?
    A. Highly concerned and/or fearful
    B. Somewhat concerned and/or fearful
    C. Neither concerned nor fearful

14. Which, if any, forces of nature are you most concerned about and/or fearful of?

15. To what extent are you concerned about and/or fearful of the impacts of human activity and technology on nature?
    A. Highly concerned and/or fearful
    B. Somewhat concerned and/or fearful
    C. Neither concerned nor fearful

16. Which, if any, impacts of human activity and technology on nature are you most concerned about and/or fearful of?

17. Which, if either, of your concerns and/or fears are greater (more significant)?
    A. Concerns and/or fears about the forces and impacts of nature on human beings
    B. Concerns and/or fears about the impacts of human activity and technology on nature
    C. Equal levels of concern and/or fear

III. Experience With Hazards

To The Best of Your Knowledge:

18. Has your household's water quality or health been affected by discharge from Buckeye Mill?
    A. Yes
    B. No
    C. Unsure

19. Has this residence ever experienced problems with water quality?
    A. Yes
    B. No
    C. Unsure

20. Have you at any residence ever experienced problems with water quality?
    A. Yes
    B. No
    C. Unsure

21. Was your residence or property damaged by the storm of March 1993 and/or Hurricane Josephine of October 1996?
    A. Yes
    B. No
    C. Unsure

22. Has this residence or property been damaged by other storms?
    A. Yes
    B. No
    C. Unsure

23. Has your residence or property anywhere been damaged by a storm or other natural hazard?
    A. Yes
    B. No
    C. Unsure

IV. Issues To Be Addressed

Please indicate your level of support for or opposition to each of the following

24. Efforts to clean up the Fenholloway River
    - A. I strongly oppose
    - B. I somewhat oppose
    - C. I am indifferent
    - D. I somewhat support
    - E. I strongly support

25. Efforts to clean up the Fenholloway River even if requiring increased taxes
    - A. I strongly oppose
    - B. I somewhat oppose
    - C. I am indifferent
    - D. I somewhat support
    - E. I strongly support

26. Efforts to clean up the Fenholloway River even if Buckeye Mill must be closed
    - A. I strongly oppose
    - B. I somewhat oppose
    - C. I am indifferent
    - D. I somewhat support
    - E. I strongly support

27.* Plans to clean up the Fenholloway River by transporting discharge from Buckeye Mill to the Gulf of Mexico by pipeline
    - A. I strongly oppose
    - B. I somewhat oppose
    - C. I am indifferent
    - D. I somewhat support
    - E. I strongly support

28. A proposal that coastal property owners assume full financial responsibility for any damages from storms and that they no longer be eligible for federal or state support
    - A. I strongly oppose
    - B. I somewhat oppose
    - C. I am indifferent
    - D. I somewhat support
    - E. I strongly support

29. A proposal to strengthen building codes for any future construction or repair of coastal structures
    - A. I strongly oppose
    - B. I somewhat oppose
    - C. I am indifferent
    - D. I somewhat support
    - E. I strongly support

30. A proposal to prohibit future development along the coast
    - A. I strongly oppose
    - B. I somewhat oppose
    - C. I am indifferent
    - D. I somewhat support
    - E. I strongly support

31. Efforts by the State of Florida to purchase with taxpayer money undeveloped land along the coast and/or other environmentally sensitive lands
    - A. I strongly oppose
    - B. I somewhat oppose
    - C. I am indifferent
    - D. I somewhat support
    - E. I strongly support

32. A requirement that in the future any proposed business or industry must demonstrate that it will not damage a community's environment before it be allowed to begin operation and employ people, even if this requirement would delay or prevent operation
    - A. I strongly oppose
    - B. I somewhat oppose
    - C. I am indifferent
    - D. I somewhat support
    - E. I strongly support

33. In your opinion, how has the overall quality of life in Florida changed over the past 50 years?
    - A. Greatly improved
    - B. Somewhat improved
    - C. Neither improved nor deteriorated (remained the same)
    - D. Somewhat deteriorated
    - E. Highly deteriorated

34. Are environmental hazards manageable?
    - A. Yes
    - B. No
    - C. Unsure

35. Who should be responsible for the management of environmental hazards?

*Responded to by only residents of coastal Taylor County

BIBLIOGRAPHY

Adams, S.M., Greeley, M.S., Ham, K.D., Hinton, D.E, LeHew, R.F., and Saylor, C.F. "Downstream gradients in bioindicator responses: point source contaminant effects on fish health." *Canadian Journal of Fisheries and Aquatic Sciences* 53, no. 10 (1996): 2177-87.

Bailey, C., and Faupel, C.E. "Out of sight is not out of mind: public opposition to ocean incineration." *Coastal Zone Management Journal* 17 (1989): 89-102.

Baker, E.J. "Public attitudes toward hazard zone controls." *Journal of the American Institute of Planners* 43, no. 4 (1977): 401-408.

Baker, E.J. "Predicting response to hurricane warnings: A reanalysis of data from four studies." *Mass Emergencies* 4, no. 1 (1979): 9-24.

Beatley, T. and Brower, D.J. "Public perception of hurricane hazards: examining the differential effects of Hurricane Diana." *Coastal Zone Management Journal* 14, no. 3 (1986): 241-69.

Buckeye Florida, *Buckeye's Commitment to Environmental Excellence: Yesterday, Today and Tomorrow*. Perry, FL: Buckeye Florida, Inc. (1997).

Burton,I., Kates, R.W., and White, G.F. "The human ecology of extreme geophysical events." Natural Hazards Research, Working Paper No. 1 University of Toronto: Department of Geography (1968).

Buttel, F.H. "Age and environmental concern." *Youth and Society* 10, no. 3 (1979): 237-56.

Buttel, F.H. and Flinn, W.L. "The structure of support for the environmental movement, 1968-1970." *Rural Sociology* 39, no. 1 (1974): 56-69.

Campbell, G.J. and Bettoli, P. W. "Behavioral reactions of fishes exposed to unbleached Kraft Mill effluent." *Bulletin of Environmental Contamination and Toxicology* 49, no. 1 (1992): 157-64.

Chambers, P.A., Pietroniro, A., and Scrimgeour, G.J. "Winter oxygen conditions in ice-covered rivers: The impact of pulp mill and municipal effluents." *Canadian Journal of Fisheries and Aquatic Sciences* 54, no.12 (1997): 2796-806.

Champoux, L. "PCBs, dioxins and furans in Hooded Merganser (Lophodytes Cucullatus), Common Merganser (Mergus Merganser) and Mink (Mustela Vison) collected along the St. Maurice River near La Tuque, Quebec." *Environmental Pollution* 92, no. 2 (1996): 147-53.

Cleslek, P.R. and Firth, B.K. "Biosensing protects water quality, keeps paper mill in production." *Industrial and Process Control Magazine* 65, no. 2 (1992): 78-81.

Couch, S.R. and Kroll-Smith, S. "Environmental controversies, interactional resources, and rural communities: Siting versus exposure disputes." *Rural Sociology* 59, no. 1 (1994): 25-44.

Couillard, C.M., Dodson, J.J., Gagnon, P., and Hodson, P.V. "Lesions and parasites in White Suckers, Catostomus Commersoni, in bleached-Kraft Pulp Mill-contaminated and reference rivers." *Environmental Toxicology and Chemistry* 14, no. 6 (1995): 1051-60.

Couillard, C.M. and Hodson, P.V. "Pigmented microphage aggregates: A toxic response in fish exposed to bleached-Kraft Mill Effluent?" *Environmental Toxicology and Chemistry* 15, no. 10 (1996): 1844-54.

Cross, J.A. "Hurricane hazards: Perceptions of new homeowners in the Lower Keys." *The Florida Geographer* 18, no. 1 (1984): 22-28.

Cutter, S.L. *Environmental Risks and Hazards*. Prentice Hall: Englewood Cliffs, N.J. (1994).

DeGroot, I. "Trends in public attitudes toward air pollution." *Journal of the Air Pollution Control Association* 17, no. 10 (1967): 679-81.

Derr, P., Goble, R., Kasperson, R.E., and Kates, R.W. "Responding to the double standard of worker and public protection." *Environment* 25, no. 6 (1983): 6-11 and 35.

Dewey, R. "The rural-urban continuum: Real but relatively unimportant." *The American Journal of Sociology* 66 (1960): 60-66.

Dube, M.G. and Culf, J.M. "Growth responses of Periphyton and Chironomids exposed to biologically treated bleached-Kraft Mill effluent." *Environmental Toxicology and Chemistry* 15, no. 11 (1996): 2019-27.

Duff, J.A. and McMillan, M.L. "Paper mill prevails in river dioxin suits." *Water Log* 17, no. 3 (1997): 5-7.

Easton, M.D.L., Dye, H.M., Kruzysnki, G.M., and Solar, I.I. "Genetic toxicity of pulp mill effluent on juvenile Chinook Salmon (Onchorhynchus Tshawytscha) using flow cytometry." *Water Science and Technology* 35 (1997): 347-55.

Edelstein, M.R. *Contaminated Communities: The Social and Psychological Impacts of Residential Toxic Exposure.* Westview Press, Inc.: Boulder, CO. (1988).

Ehrlich, E., Johnson, G.W., Paustenbach, D.J., Su, S.H., and Wenning, R.J. "A mixing model for polychlorinated dibenzo-p-dioxins and dibenzofurans in surface sediments from Newark Bay, New Jersey using polytopic vector analysis." *Archives of Environmental Contamination and Toxicology* 27, no. 4 (1994): 486-500.

Emel, J. and Peet, R. "Resource management and natural hazards" in *New Models in Geography: The Political-Economy Perspective*, R. Peet and N. Thrift, eds., Unwin Hyman, Inc.: London (1989): 49-76.

Fischer, C.S. "Urban-to-rural diffusion of opinions in contemporary America." *The American Journal of Sociology* 84, no. 1 (1978): 151-59.

Fischhoff, B., Watson, S.R., and Hope, C. "Defining risk." *Policy Sciences* 17 (1984): 123-39.

Florida Department of Environmental Protection. *Use Sustainability Analysis: Fenholloway River*, Department of Environmental Protection: Tallahassee, FL (1994).

Forrest, R. "Freeze-dried-crystallization system key to zero-effluent pulp mill." *Pulp and Paper Journal* 44, no. 7 (1991): 29-31.

Fowlkes, M.R. and Miller, P.Y. "Chemicals and community at Love Canal," in *The Social and Cultural Construction of Risk*, B.B. Johnson and V.T. Covello, eds., D. Reidel Publishing Co. (1987): 55-78.

Gagnon, M.M., Bussieres, D., Dodson, J.J., and Hodson, P.V. "White sucker (Catostomus Commersoni) growth and sexual maturation in pulp mill-contaminated and reference rivers." *Environmental Toxicology and Chemistry* 14, no. 2 (1995): 317-27.

Gainesville Sun. "River Cleanup Approved." December 16 (1994) 1B and 8B.

Gainesville Sun. “State Mulls Fenholloway Cleanup Plan.” December 15 (1994) 1B and 7B.

Gainesville Sun. “DEP Designates Pollution Site.” October 13 (1995) 1B and 2B.

Gainesville Sun. “State May Face Worse Pollution.” November 23 (1994) 1B and 4B.

Gardner, G.T. and Gould, L.C. "Public perception of the risks and benefits of technology." *Risk Analysis* 9, no. 2 (1989): 225-42.

Glenn, N.D. and Alston, J.P. "Rural-urban differences in reported attitudes and behavior." *The Southwestern Social Science Quarterly* 47 (1967): 381-400.

Glenn, N.D. and Hill, L. "Rural-urban differences in attitudes and behavior in the United States." *Annals of the American Academy of Political and Social Science* 429 (1973): 36-50.

Grasmick, H.G. and Grasmick, M.K. "The effect of farm family background on the value orientation of urban residents: A study of cultural lag." *Rural Sociology* 43, no. 3 (1978): 367-85.

Greenberg, M.R., Anderson, R.F., and Rosenberger, K. "Social and economic effects of hazardous waste management sites." *Hazardous Waste* 1, no. 3 (1984): 387-96.

Hall, W.W. "Households attitudes toward environmental quality in a coastal South Carolina county." *Coastal Zone Management Journal* 1, no. 4 (1974): 347-64.

Harrell, R.C. and McConnell, M.A. "The estuarine clam Rangia Cuneata as a biomonitor of dioxins and furans in the Neches River, Taylor Bayou, and Fence Lake, Texas." *Estuaries* 8, no. iB (1995): 264-70.

Hatt, P. and Reiss, A.J., Jr., eds. *Cities and Society*. Free Press (1957).

Hewitt, K. "The environment as hazard: A review." *Annals of the Association of American Geographers* 70, no. 1 (1980): 306-11.

Hewitt, K. "The idea of calamity in a technocratic age," in *Interpretations of Calamity From the Viewpoint of Human Ecology*, K. Hewitt, ed., Allen & Unwin, Inc.: Boston, MA (1983): 3-32.

Hohenemser, C., Kates, R.W., and Slovic, P. "The nature of technological hazard." *Science* 220, no. 4595 (1983): 378-84.

Hollander, M. and Wolf, D. *Non-Parametric Statistical Methods*. Wiley Publishing Co.: New York, NY (1973).

Hontela, A., Daniel, C., and Rasmussen, J.B. "Structural and functional impairment of the hypothalamo-pituitary-interrenal axis in fish exposed to bleached Kraft Mill effluent in the St. Maurice River, Quebec." *Ecotoxicology* 6, no. 1, pp. 1-12.

Huntley, S.L., Luksemberg, W.J., Paustenbach, D.J., Wenning, R.J., and Wong, A.S. "Potential sources of polychlorinated dibenzothiophenes in the Passaic River, New Jersey." *Chemosphere* 29, no. 2 (1994): 257-272.

Ives, S.M. and Furuseth, O.J. "Community response to coastal erosion: The view from two North Carolina beach areas." *Ocean and Shoreline Management* 11 (1988): 177-93.

Kasperson, R.E., Brown, H.S., Emel, J., Goble, R., Kasperson, J.X., Ratick, S., Renn, O., and Slovic, P. "The social amplification of risk: A conceptual framework." *Risk Analysis* 8, no. 2 (1988): 177-87.

Kates, R.W. "Natural hazards in human ecological perspective: Hypotheses and models." *Economic Geography* 47, no. 3 (1971): 438-51.

Kates, R.W. "Success, strain, and surprise." *Issues in Science and Technology* 2, no. 1 (1985): 46-58.

Kenefick, S.L., Brownlee, B.G., Hrudey, S.E., and Low, N.J. "A review of off-flavour tainting of drinking water and fish by pulp mill effluents." *Water Science and Technology* 31, no. 11 (1995): 55-61.

Kenefick, S.L., Brownlee, B.G., Hrudey, S.E., and Perley, T.R. "A chemical and sensory study of odour compounds in the Athabasca River, Alberta, Canada." *Water Science and Technology* 31, no. 11 (1995): 15-21.

Klinker, R.T., and Wieland, A. "Hennepin paper's zero discharge program and wastewater recycling system." *Pollut. Prev. Rev* 3, no. 3 (1993): 307-16.

Kloepper-Sams, P.J. and Benton, E. "Exposure of fish to biologically treated bleached-Kraft effluent: induction of hepatic cytochrome P4501A in mountain whitefish (Prosopium Williamsoni) and other species." *Environmental Toxicology and Chemistry* 13, no. 9 (1994): 1483-96.

Kloepper-Sams, P.J., Marchant, T., Owens, J.W., Schryer, R., and Swanson, S.M. "Exposure of Fish to biologically treated bleached-Kraft effluent: Biochemical, physiological, and pathological assessment of Rocky Mountain whitefish (Prosopium Williamsoni) and longnose sucker (Catostomus)." *Environmental Toxicology and Chemistry* 13, no. 9 (1994): 1469-82.

Lowe, G.D. and Peck, C.W. "Location and lifestyle: The comparative explanatory ability of urbanism and rurality." *Rural Sociology* 39, no. 3 (1974): 392-420.

Lowe, G.D. and Pinhey, T.K. "Rural-urban differences in support for environmental protection." *Rural Sociology* 47, no. 1 (1982): 114-28.

Lowell, R.B., Culp, J.M., and Wrona, F.J. "Stimulation of increased short-term growth and development of mayflies by pulp mill effluent." *Environmental Toxicology and Chemistry* 14, no. 9 (1995): 1520-41.

Lynne, G.D. and Rola, L.R. "Improving attitude-behavior prediction models with economic variables: Farmer actions toward soil conservation." *The Journal of Social Psychology* 128, no. 1 (1987): 19-28.

Marks, R.G. *Analyzing Research Data: The Basics of Biomedical Research Methodology*. R.E. Krieger Publishing Co., Inc.: Malabar, FL (1982).

McKinney, A.D. and Wade, D.C. "Comparative response of Ceriodaphnia Dubia and juvenile Anodonta Imbellicis to pulp and paper mill effluents discharged to the Tennessee River and its tributaries." *Environmental Toxicology and Chemistry* 15, no. 4 (1996): 514-17.

Mercaldo-Allen, R., Greig, R.A., Kuropat, C.A., and Sennefelder, G. "PCB and metal concentrations in American lobsters from the Acushnet River estuary and Long Island Sound." *Bulletin of Environmental Contamination and Toxicology* 53, no. 6 (1994): 820-27.

Mitchell, J.K. "Natural hazards research," in *Perspectives on Environment*, I.R. Manners and M.W. Mikesell, eds., Association of American Geographers: Washington, D.C. (1974): 311-41.

Mitchell, J.K. "Hazards research." *Geography in America*, G.L. Gaile and C.J. Willmott, eds., Merrill Publishing Co. (1989): 410-24.

Mohai, P. and Twight, B.W. "Age and environmentalism: An elaboration of the Buttel Model using national survey evidence." *Social Science Quarterly* 68 (1987): 798-815.

Montz, B. and Gruntfest, E.C. "Changes in American urban floodplain occupancy since 1958: The experiences of nine cities." *Applied Geography* 6 (1986): 325-38.

Morell, D.l. and Singer, G.L. "Energy facility siting in the urban coastal zone: Compatible or not?" *Coastal Zone Management Journal* 6 (1979): 215-32.

O'Riordan, T. "The challenge for environmentalism" in *New Models in Geography: The Political-Economy Perspective*, R. Peet and N. Thrift, eds., Unwin Hyman, Inc.: London (1989): 77-102.

O'Riordan, T. and Rayner, S. "Chasing a specter: Risk management for global environmental change," in *Understanding Global Environmental Change: The Contributions of Risk Analysis and Management,* R.E. Kasperson, K. Dow, D. Golding, and J.X. Kasperson, eds., Clark University: Worcester, MA (1990): 45-62.

Ott, R.L. *An Introduction to Statistical Methods of Data Analysis*. Wadsworth, Inc.: Belmont, CA. (1993).

Owens, J.W., Birkholz, D.A., and Swanson, S.M. "Environmental monitoring of bleached Kraft Pulp Mill chlorophenolic compounds in a northern Canadian river system." *Chemosphere* 29, no. 1 (1994): 89-109.

Pagan, L. "OCS development: A community's acceptance of risk." *Coastal Zone Management Journal* 7 (1980): 223-36.

Peterman, P.H. and Delfino, J.J. "Identification of Isopropylbiphenyl, Alkyl Diphenylmethanee, Diisopropylnapthalene, linear alkyl benzenes and other polychlorinated biphenyl replacement compounds in effluents, sediments and fish in the Fox River system, Wisconsin." *Biomed. Environ. Mass Spectrosc.* 19 (1990): 755-70.

Pinhey, T.K. and Patterson, K.W. "Environmental concern as a factor in coastal zone development: A study of Louisiana citizens." *Coastal Zone Management Journal* 2, no. 3 (1976): 297-310.

Prahacs, S.M., Duncan, W., and Hall, K.J. "Leeches as in situ biomonitors of chlorinated phenolic compounds. Part 2: Pulp mill investigations." *Water Research* 30, no. 10 (1996): 2301-08.

Prester, G., Rohrmann, B., and Schellhammer, E. "Environmental evaluations and participation activities: A social psychological field study." *Journal of Applied Social Psychology* 17, no. 9 (1987): 751-87.

Raloff, J. "How paper mill wastes may imperil fish." *Science News* 148, no. 19 (1995): 295.

Renner, R. "Fox River sediment study to produce cleanup strategies." *Environmental Science and Technology* 29, no. 9 (1995): 401A.

Rogers, I.H., Levings, C.D., Lockhart, W.L., and Norstrom, R.J. "Observations on overwintering juvenile chinook salmon (Oncorhynchus Tshawytscha) exposed to bleached Kraft Mill effluent in the Upper Fraser River, British Columbia." *Chemosphere* 19, no. 12 (1989): 1853-68.

Rolston, H., III. *Environmental Ethics: Duties to and Values in the Natural World.* Temple University Press: Philadelphia, PA (1988).

Servizi, J.A., Carey, J.H., and Gordon, R.W. "Bioconcentration of chlorophenols by early life stages of Fraser River pink and chinook salmon (Oncorhynchus Gorbuscha, Oncorhynchus Tshawytscha)." *Water Pollution Research Journal of Canada* 23, no. 1 (1988): 88-99.

Sjoberb, G. "The Rural-urban dimension in preindustrial, transitional, and industrial societies" in *Handbook of Modern Sociology*, R.E.L. Feris, ed. Rand Mcnally and Company (1964): 127-169.

Starr, C. "Social Benefit versus Technological Risk." *Science* 165, no. 3899 (1969): 1232-38.

Starr, C. and Whipple, C. "Risks of Risk Decisions." *Science* 208, no. 4448 (1980): 1114-19.

Stern, P.C. "Psychological dimensions of global environmental change." *Annual Review of Psychology* 43 (1992): 269-302.

Stewart, C.T., Jr. "The urban-rural dichotomy: Concepts and uses" *The American Journal of Sociology* 64 (1958): 152-58.

Summers, J.K., Kazyak, P.F., and Weisberg, S.B. "A water quality model for a river receiving paper mill effluents and conventional sewage." *Ecolological Modelling*, 58 (1991): 25-54.

Swanson, S.M., Kloepper-Sams, P.J., Owens, J.W., Schryer, R., and Shelast, R. "Exposure of fish to biologically treated bleached Kraft-Mill effluent: Fish habitat and population assessment." *Environmental Toxicology and Chemistry* 13, no. 9 (1994): 1497-1507.

Tallahassee Democrat. "River gets a second chance." December 16 (1994): 1B and 2B.

Tallahassee Democrat. "Finally, the Fenholloway River will be rid of industrial rank." December 17 (1994).

Tampa Tribune. "State panel approves upgrade for 'Industrial' river." December 16 (1994): 12.

Taylor County Chamber of Commerce. *Progress A Guide to Perry/Taylor County, Florida: 1997.* Perry, FL, March 28 (1997).

Taylor County Emergency Management. *Taylor County Comprehensive Emergency Management Plan.* Emergency Management: Perry, FL (1998).

Tobin, G.A. and Montz, B.F. *Natural Hazards: Explanation and Integration.* The Guilford Press: New York, NY (1997).

Tozer, H.G. "Now you see it, now you don't." *Ind. Wastewater* 2, no. 2 (1994): 33-40.

Tremblay, K.R. and Dunlap, R.E. "Rural-urban residence and concern with environmental quality: A replication and extension." *Rural Sociology* 43, no. 3 (1978): 474-91.

Van Liere, K.D. and Dunlap, R.E. "The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence." *Public Opinion Quarterly* 44 (1980): 181-97.

Waterstone, M. "Risk analysis and management of natural and technological hazards: A social/behavioral science perspective," in *Risk Analysis and Management of Natural and Man-Made Hazards,* Y.Y. Haines and E.Z. Stakhiv, eds. American Society of Engineers (1989): 72-80.

Weaver, P.M. "How life cycle analysis and operational research methods could help clarify environmental Policy: The Case of Fibre Recycling in the Paper/Pulp Sector." International Geographical Union Conference: Budapest (1994).

Weiss, E.B. "In fairness to future generations." *Environment* 32, no. 3 (1990): 7-11 and 30-31.

White, G.F. "Natural hazards research," in *Directions in Geography*, R.J. Chorley, ed. Methuen & Co.: London (1973): 193-216.

White, G.F. "Paths to risk analysis." *Risk Analysis* 8, no. 2 (1988): 171-75.

Whitt, H.P. and Nelson, H.M. "Residence, moral traditionalism, and tolerance of atheists." *Social Forces* 54, no. 2 (1975): 328-40.

Willis, F.K., Bealer, R.C., and Crider, D.M. "Leveling of attitudes in mass society: Rurality and traditional morality in America." *Rural Sociology* 38, no. 1 (1973): 37-45.

Wirth, L. "Urbanism as a way of life." *The American Journal of Sociology* 44, no. 1 (1938): 1-24.

BIOGRAPHICAL SKETCH

Stephen N. Martin was born in Palm Beach County, Florida, in 1954 and raised in the northeastern United States. He returned to Palm Beach County near the end of his childhood and graduated from Atlantic High School in Delray Beach. In 1978, he received a bachelor of science degree in psychology from Reed College in Portland, Oregon. In the 1980s, he received master of science degrees in geography and in mathematics education from Florida State University in Tallahassee, Florida, as well as a master of arts degree in philosophy from Colorado State University in Fort Collins, Colorado. He later attended the University of Florida in Gainesville, Florida, and obtained this Ph.D. in 1999.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Caviedes

Cesar N. Caviedes, Chairman
Professor of Geography

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Abraham C. Goldman

Abraham C. Goldman
Associate Professor of Geography

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Joann Mossa
Associate Professor of Geography

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Jonathan Reiskind
Associate Professor of Zoology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Walter A. Rosenbaum
Professor of Political Science

This dissertation was submitted to the Graduate Faculty of the Department of Geography in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

May 1999

Dean, Graduate School